

<b>बी एच ई एल</b> <b>BHEL</b>	<div style="text-align: center;"> <b>BHARAT HEAVY ELECTRICALS LIMITED</b>  TRANSMISSION BUSINESS ENGINEERING MANAGEMENT </div>										
	DOCUMENT No.	TB-395-607-000-JER-PKG-BAL-04				Rev. No.	00		Prepared	Checked	Approved
	TYPE OF DOC.	TECHNICAL SPECIFICATION				SIGN	-sd-		-sd-	-sd-	
	<b>TITLE</b>  <b>SPECIFICATION FOR BALANCE CIVIL WORKS FOR 765KV S/S AND SPR BUILDING AT JEERAT IN WEST BENGAL</b>					NAME	VG		AKM	PLK	
						DATE	08.10.20		08.10.20	08.10.20	
						GROUP	TBEM		W.O. No	86006	
	CUSTOMER	POWERGRID MEDINIPUR-JEERAT TRANSMISSION LIMITED, KOLKATA (M/S PMJTL)									
	CONSULTANT	POWERGRID CORPORATION OF INDIA LIMITED									
	PROJECT	765/400KV SUB-STATION AT JEERAT, WEST BENGAL									
		<b>CONTENTS</b>									
	<b>Section</b>	<b>Description</b>								<b>No. of Sheets</b>	
	1	SCOPE, SPECIFIC TECHNICAL REQUIREMENT & SCHEDULE OF ITEMS								3	
	2	STANDARD TECHNICAL SPECIFICATION								N.A	
	3	ENCLOSURES TO THE SPECIFICATION									
		CUSTOMER SPECIFICATION									
Rev No.	Date	Altered	Checked	Approved			REVISION DETAILS				
Distribution				To	O/C	TBES					
				Copies	1	1					

# **SECTION -1**

**SCOPE, SPECIFIC TECHNICAL REQUIREMENTS &  
QUANTITIES**

**SCOPE, SPECIFIC TECHNICAL REQUIREMENTS  
& QUANTITIES**

**1.1.0 SCOPE**

1.1.1 The scope of work under this specification is civil works for construction of balance civil work of 765/400kV Switch-Yard at Jeerat Substation, being executed by BHEL on turnkey basis. The Customer is M/s PMJTL and Consultant is M/s Powergrid Corporation of India Limited.

1.1.2 The Civil Works shall generally include, *but not limited to*, following:  
2 (i.). Equipment foundation works  
(ii.). All Building Works including indoor cable trenches for Switchyard Panel Rooms including connection with outer trench/pipe etc  
(iii.) Cable Pull Pit, Culvert or any other work required for the project.

2.1.1 The works to be performed in the above construction including taking over of land from BHEL/Customer by locating boundary wall/ work coordinates, level of earth using total station and verification of input data provided by BHEL/customer at site, 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 equipment like hydraulic excavator, dozer, tipper, Power roller, Vibratory roller etc, 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 including dewatering, shoring, strutting, and filling under and around structures, backfilling with available excavated earth around completed structures, transportation & leveling and compaction of surplus earth in low lying area including clearing the land for development from plants & bush vegetation, removal of roots of trees & plants, cable trenches with covers, disposal of surplus soil, formwork, providing necessary steel embedment, Grating 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.

**1.2.0 SPECIFIC TECHNICAL REQUIREMENT**

1.2.1 All technical requirements shall be as per POWERGRID Technical Specification (Refer SECTION 3)/Latest CPWD specification/IS Codes. In case of any difference between Powergrid Technical Specification and latest CPWD Specification/IS code, the provision of Powergrid Technical specification shall be considered.

**1.3.0 BILL OF QUANTITIES**

1.3.1 The Bill of Quantity shall be as per page 3 to page 7

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.

**1.3.4 Method of measurement:**

1.3.4.1 Excavation for foundation work 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 of foundation work 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. This clause shall be applicable for all types of soil and rock.

Where rock and soil is 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, medium rock & hard rock are mixed, the measurement of the excavation shall be made as per PCC dimensions. Excavated materials comprising of the soft rock, medium 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, medium 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.

Clause No. 10.0 of PGCIL Specification for mode of measurement shall not be applicable in this contract.

For other items, unless otherwise described in 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.



Name of Project: 765/400kV Sub-Station, Jeerat (West Bengal)

Name of Work: BALANCE CIVIL WORKS FOR 765KV S/S AND SPR BUILDING AT JEERAT IN WEST BENGAL

Sl. No.	DESCRIPTION	UNIT	UNIT RATE EXCL. GST	QTY	AMOUNT
1	2	3	4	5	6
1	Earthwork in excavation over areas (exceeding 30cm in depth 1.5m in width as well as 10sqm on plan) including dewatering as necessary of rain water/subsoil seepage water and disposal of excavated earth upto 100m and lift upto 3.6m, disposed earth to be levelled and neatly dressed.				
(a)	All kinds of soil.	cum	125.95	5500	692725.00
2	Earthwork in excavation in foundation, trenches or drains (not exceeding 1.5m in width as well as 10sqm on plan) including dewatering as necessary of rain water/subsoil seepage water and dressing of sides and ramming of bottoms, lift upto 3.6m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 100m.				
(a)	All kinds of soil.	cum	166.40	400	66560.00
3	Extra for every additional lift of 1.5 m or part thereof in excavation /banking excavated or stacked materials.				
(a)	All kinds of soil.	cum	51.75	520	26910.00
4	Filling available excavated earth (including rock) 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 3.6m.	cum	125.75	4600	578450.00
5	Supplying and filling in plinth with Jamuna/local sand under floors including watering, ramming, consolidating and dressing etc all complete	cum	810.82	25	20270.50
6	Supplying, filling and compacting stone boulders, hard core of stone ballast etc mixed with sand at the site under floors, foundations, roads, cable trenches, drains, etc. in layers not exceeding 200mm thickness including royalty, carriage 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.	cum	1645.41	30	49362.30
7	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 -.				0.00
(a)	Lead upto 1 km.	cum	98.34	1100	108174.00
8	Supplying chemical emulsion in sealed containers including delivery as specified.				
(a)	Chloropyrphos emulsifiable concentrate of 20%	litre	157.45	8	1180.88
9	Diluting and injecting chemical emulsion for POST-CONSTRUCTIONAL anti- termite treatment (excluding the cost of chemical emulsion) :				
(a)	Along external wall where the apron is not provided using chemical emulsion @ 7.5 litres / sqm of the vertical surface of the substructure to a depth of 300 mm including excavation channel along the wall &rodding etc. complete:				
(i.)	With Chlorpyrphos/ Lindane E.C. 20% with 1% concentration.	RM	16.80	80	1344.00
(b)	Along the external wall below concrete or masonry apron using chemical emulsion @ 2.25 litres per linear metre including drilling and plugging holes etc.				
(i.)	With Chlorpyrphos/ Lindane E.C. 20% with 1% concentration.	RM	24.30	80	1944.00
(c)	Treatment of soil under existing floors using chemical emulsion @ one litre per hole, 300 mm apart including drilling 12 mm diameter holes and plugging with cement mortar 1 :2 (1 cement : 2 Coarse sand) to match the existing floor :				
(i.)	With Chlorpyrphos/Lindane E.C. 20% with 1% concentration.	Sqm	131.90	80	10552.00
10	Providing and laying damp proof course 50mm thick cement concrete 1:1.5:3 (1 Cement:1.5 coarse sand : 3 graded stone aggregate 12.5 mm nominal size).	Sqm	293.35	27	7920.45
11	Applying a coat of residual petroleum bitumen of penetration 80/100 of approved quality using 1.7 kg per sqm on damp proof course after cleaning the surface with brushes and finally with a piece of cloth lightly soaked in kerosene oil.	Sqm	88.05	27	2377.35
12	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering:				
(a)	1:4:8 (1 cement : 4 fine sand : 8 graded stone aggregate 40 mm nominal size)	cum	3919.79	116	454695.64
(c)	1:2:4(1 cement :2 fine sand : 4 graded stone aggregate 40 mm nominal size)	cum	4943.80	25	123595.00

Sl. No.	DESCRIPTION	UNIT	UNIT RATE EXCL. GST	QTY	AMOUNT
1	2	3	4	5	6
13	Grouting of block outs, pockets, foundations, bolts holes and underside of base plates with cement, sand aggregate ( of size 6 mm and down) grout 1:1:2 with non-shrink additive/grouting compound and shall be of strength not less than M30 including placing, curing, cleaning, surface preparation, testing, etc. complete with labour, materials, equipment, handling, testing, etc. all complete as per specifications, drawings and instructions of the Engineer.	cum	7705.97	6	49318.21
14	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 concrete 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, retard setting of concrete, improve workability without impairing strength and durability. - M25 grade. (Note:- Cement content considered in M-25 is @330 kg/cum).				
(i.)	All works up to plinth level	cum	5887.43	957	5634270.51
(ii.)	All works above plinth level to floor V level	cum	6691.00	27	180657.00
15	Add for using extra cement in the items of design mix over and above the specified cement content therein.	Quintal	533.82	522	278680.73
16	Centering and shuttering including strutting, propping etc. and removal of form for :				
(a)	Foundations, footings, bases of columns, etc. for mass concrete.	Sqm	184.42	530	97742.60
(b)	Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc.	Sqm	369.24	431	159142.44
(c)	Suspended floors, roofs, landings, balconies and access platform.	Sqm	413.62	225	93064.50
(d)	Lintels, beams, plinth beams, girders, bressumers, chajjas and cantilevers.	Sqm	333.23	119	39614.38
(e)	Columns, Pillars, Piers, Abutments, Posts and Struts.	Sqm	454.41	1250	568012.50
17	Extra for additional height in centring, shuttering wherever required with adequate bracing, propping etc. including cost of deshuttering and decentering at all levels over a height of 3.5 meter for every additional height of 1 meter or part thereof (Plan area to be measured).				
(i.)	Suspended floors, roofs, landing, beams and balconies.	Sqm	169.97	215	36543.55
18	Steel reinforcement of grade Fe-500/500D TMT bars				
(a)	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.	Kg	49.62	5000	248100.00
(b)	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 are also includes Unloading, storage, watch and ward etc for BHEL supplied Reinforcement).	Kg	11.11	61000	677710.00
19	Structural steel work welded in built up sections like edge protection angles, pipes, 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.	Kg	51.36	4350	223416.00
20	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.				
(a)	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.	Kg	56.66	6900	390954.00
(b)	In gratings, frames, ladders, stair railings, gates (including pipes), rails, ISMB, ISMC and similar works.	Kg	78.07	5000	390350.00
21	Brick work with common burnt clay F.P.S. bricks as per Technical Specification of class designation 7.5 in foundation and plinth including weep holes:				
	Cement mortar 1:6 (1 cement : 6 coarse sand)	cum	4524.10	8	36346.62
22	Brick work with common burnt clay F.P.S. bricks as per Technical Specification of class designation 7.5 in superstructure above plinth level up to floor V level in all shapes and sizes including weep holes :				
	Cement mortar 1:6 (1 cement : 6 coarse sand)	cum	5355.29	129	690778.86
23	6mm cement plaster to ceiling of mix 1:3 (1 cement : 3 fine sand)	Sqm	138.39	129	17852.31
24	12mm cement plaster on the wall/ concrete surface in the mix: 1:6 (1 cement: 6 fine sand)	Sqm	154.72	270	41774.40

Sl. No.	DESCRIPTION	UNIT	UNIT RATE EXCL. GST	QTY	AMOUNT
1	2	3	4	5	6
25	18mm cement plaster on roof in two coats with under layer 12mm thick cement plaster 1:5 (1 cement :5 coarse sand ) finished with a top layer of 6mm thick 1:6 cement plaster(1cement : 6 fine sand)	Sqm	245.49	460	112925.40
26	Add for plaster drip course/ groove in plastered surface or moulding to R.C.C. projections.	RM	34.15	133	4547.07
27	Making plinth protection of 50mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) laid over 75mm thick bed of dry brick balast 40mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth.	Sqm	426.82	31	13188.74
28	Providing and laying 75 mm thick compacted bed of dry brick aggregate of 40 mm thick nominal size including spreading,well ramming, consolidating and grouting with jamuna sand, including finishing smooth etc. complete as per direction of Engineer-in-charge.	Sqm	136.33	31	4212.60
29	Providing and fixing chicken wire mesh on wall, floor & ceiling surface all complete as per drawing/specification and direction of Engineer-in charge.	Sqm	40.89	618	25270.02
30	Providing and laying polished vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption's less than 0.08% and conforming to IS: 15622 of approved make in all colours and shades laid over 20mm thick cement mortar 1:4 (1 Cement:4 coarse sand) and jointing with grey cement slurry @3.3 kg/sqm including grouting the joints with white cement and matching pigments etc. complete as per direction of Engineer-in charge.				
	Size of tile 60 x 60 cm	Sqm	990.82	31	30616.34
31	Providing and fixing approved quality polished vitrified tiles (thickness to be specified by the manufacturer) of approved make and colours in skirting,risers of steps and dados over 12 mm thick bed of Cement mortar 1:3 (1 Cement:3 coarse sand ) and jointing with grey cement slurry @3.3 kg/sqm including pointing in white cement mixed with pigment of matching shade complete.				
	Size of tile 60 x 60 cm	Sqm	1010.07	18	18635.79
32	Providing and laying Polished Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building, all complete as per the architectural drawings, with 18 mm thick stone slab over 20 mm average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand), laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade, including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge				
(a)	Polished Granite stone slab jet Black, Cherry Red, Elite Brown, Cat Eye or equivalent.	Sqm	2560.03	12	30720.36
33	Providing and laying polished Granite stone 18-20mm thk in skirting and dado with 6mm thick projection from adjacent plaster including mortar ,cement slurry ,pigments, curing, grinding,moulding, granite polishing etc. all complete.	Sqm	3010.10	5	15050.50
34	Providing and fixing min. 20mm thick mirror polished, premoulded and prepolished, machine cut for column facia, kitchen platforms, vanity counters, window sills, facia and similar locations 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 etc. complete at all levels and sizes				
(a)	Granite black or customer approved color	Sqm	2762.11	2	5524.22
35	Providing and applying <b>white cement based putty</b> of average thickness 1mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth as directed by engineer-in-charge for all level and height.	Sqm	82.18	450	36981.00
36	Providing and applying plaster of paris putty of 2 mm thickness over plastered surface to prepare the surface even and smooth complete at all level and height	Sqm	117.08	300	35124.00
37	Applying priming coat				
(a)	With ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanised iron/ steel works.	Sqm	15.19	2400	36456.00
38	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade:				
(a)	Two or more coats on new work of approved brand and manufacture	Sqm	74.91	247	18517.75
39	Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade at all level and height				

Sl. No.	DESCRIPTION	UNIT	UNIT RATE EXCL. GST	QTY	AMOUNT
1	2	3	4	5	6
(a)	New work (two or more coats) over and including priming coat with cement primer.(Work to be carried as per relevant IS codes.)	Sqm	91.81	300	27543.00
40	Finishing walls/ Slab with Premium Acrylic Smooth exterior paint with Silicone additives of required shade at all level and height:				
(a)	New work : (Two or more coat applied @ 1.43 ltr/10 sqm over and including primer coat of exterior primer applied @ 2.20 kg/10 sqm).	Sqm	89.57	600	53742.00
41	Providing and fixing aluminium work for doors, windows, ventilators and partitions with extruded builtup 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. Aluminium sections shall be smooth , rust free, straight, mitred and jointed mechanically wherever required including cleat angle, aluminium snap beading for glazing/panelling, CP brass/stainless steel screws, all complete as per architectural drawings and direction of Engineer-in-charge. (Glazing and panelling to be paid for separately).				
(a)	For Fixed Portion				
	Powder coated aluminium (minimum thickness of podwer coating 50 micron)	Kg	334.55	36	12043.80
(b)	For shutters of doors, windows & ventilators including providing and fixing hinges/pivots and fittings wherever required including the cost of PVC/neoprene gasket required .				
	Powder coated aluminium (minimum thickness of podwer coating 50 micron)	Kg	391.32	30	11739.60
42	Providing and fixing glazing in aluminium door, window, ventilator shutters and partitions, etc., with PVC/neoprene gasket, etc., complete as per the architectural drawings and directions of Engineer-in-charge. (Cost of aluminium snap beading shall be paid in basic item).				
(a)	With float glass panes of 5.5mm (minimum) thickness (weight not less than 13.75kg/sqm)	Sqm	886.51	50	44325.50
(b)	With 5.5mm (minimum) thick toughened reflective glass	Sqm	1581.79	30	47453.70
43	Providing and fixing chromium plated brass 100 mm mortice latch and lock with 6 levers and a pair of lever handles with necessary screws etc. complete(best make of approved quality).	Each	590.20	6	3541.20
44	Providing and fixing aluminium sliding door bolts anodised (anodic coating not less than grade AC 10 as per IS: 1868) transparent or dyed to required colour or shade with nuts and screws etc. complete.				
(a)	300 X 16 mm	Each	184.35	3	553.05
(b)	150 X 10mm	Each	55.22	3	165.66
45	Providing and fixing aluminium handles anodised (anodic coating not less than grade AC 10 as per IS: 1868) transparent or dyed to required colour or shade with necessary screws etc., complete.				
(a)	125mm	Each	43.86	3	131.58
(b)	100mm	Each	38.77	3	116.31
46	Providing and fixing IS:3564 marked aluminium die cast body tubular type universal hydraulic door closer of approved quality and make with accessories and screws complete.	Each	358.96	5	1794.80
47	Providing and fixing pressed steel door frames manufactured from commercial mild steel sheet of 1.25mm thickness including hinges, jamb, lock jamb, bead and if required angle threshold of mild steel angle of section 50X25mm, or base ties of 1.25mm pressed mild steel welded or rigidly fixed together by mechanical means, adjustable lugs with spit end tail to each jamb including steel butt hinges 2.5mm thick with mortar guards, lock strike plate and shock absorbers as specified and applying a coat of approved steel primer after pre-treatment of the surface as directed by Engineer-in-Charge:				
(a)	Profile C	RM	318.17	42.5	13522.23
48	Providing and fixing ISI marked flush door shutters decorative type, core of block board construction with frame of 1st class hard wood and well matched reak 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters.				
(a)	35 mm thick including ISI marked Stainless Steel butt hinges with nessary screws.	Sqm	2148.42	16.5	35448.93

Sl. No.	DESCRIPTION	UNIT	UNIT RATE EXCL. GST	QTY	AMOUNT
1	2	3	4	5	6
49	Providing and fixing on wall face unplasticised - Rigid PVC rain water pipes conforming to IS : 13592 Type A including jointing with seal ring conforming to IS : 5382 leaving 10 mm gap for thermal expansion, (i) Single socketed pipes including all fittings like bends, bat clamps gratings etc.				
(a)	110 mm diameter	RM	211.92	28	5933.76
50	Providing and fixing on wall face unplasticised - PVC moulded fittings/ accessories for unplasticised - Rigid PVC rain water pipes conforming to IS : 13592 Type A including jointing with seal ring conforming to IS : 5382 leaving 10 mm gap for thermal expansion Single socketed pipes.				
(a)	110 mm bend 87.5 degree	each	99.94	10	999.4
(b)	110 shoe plain	each	87.15	10	871.5
51	<b>Making khurras 45X45cm</b> with average minimum thickness of 5cm cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20mm nominal size) over PVC sheet 1mX1mX400micron, finished with 12mm cement plaster 1:3 (1 cement: 3 coarse sand) and a coat of neat cement rounding the edges and making and finishing the outlet complete.	Each	178.17	16	2850.72
52	Providing and laying 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 upto300mm height including cleaning the surface before treatment. b)Laying brick bats with mortar using broken bricks/brick bats 25 mm to115mm 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 waterproofing 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 2.75kg/ 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 jointless cement mortar of mix1:4 (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 3mm 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 :				
(a)	With average thickness of 120mm and minimum thickness at khurra as 65 mm.	Sqm	954.20	193	184160.60
53	Providing and fixing in position in culvert/road crossing/building PVC pipes conforming to IS : 12818 including jointing with seal all complete as per drawing and specification.				
(a)	150mm diameter	RM	211.92	8	1695.36
54	Fixing of foundation bolts in position with help of proper templates (to be supplied by contractor) including nuts and washers all complete as per drawings & directions of Engr-in-Charge. Note: 1.) Weight of the template shall not be measured for payment purpose. 2.) The Dia and Length of BHEL Supplied Foundation bolt may vary upto 80mm & 2.4 metre respectively. 3.) Rates are also includes Unloading, storage, watch and ward etc for BHEL supplied Foundation Bolt	Kg	9.20	14200	130640.00
55	Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete :				
(a)	300 mm dia. R.C.C. pipe	RM	459.59	12	5515.08
56	Demolishing cement concrete manually/by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 meter lead as per direction of				
(a)	Nominal concrete 1:3:6 or richer mix (i/c equivalent design mix)	CUM	997.05	3	2991.15
(b)	Nominal concrete 1:4:8 or leaner mix (i/c equivalent design mix)	CUM	615.15	3	1845.45
57	Demolishing R.C.C. work manually/by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 meter lead as per direction of Engineer-in-charge	CUM	1454.55	10	14545.50
<b>TOTAL AMOUNT (RS)</b>					<b>12992329.39</b>

## **SECTION -2**

**STANDARD TECHNICAL SPECIFICATION**

**N.A**

## **SECTION -3**

### **ENCLOSURES TO THE SPECIFICATION**

- (a) Customer Specification: Technical Specification, Section: Civil Works-ERSS-XVIII
- (b) Standard Field Quality Plan

## SECTION: CIVIL

### 1.0 GENERAL

The intent of this technical specification covers the following

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

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

All materials including cement, reinforcement steel and structural steel etc. shall be arranged by the Contractor. All testing required shall be arranged by the Contractor at his own cost. The Contractor shall execute the work as per latest field quality plan available on POWERGRID website.

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

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

### 2.0 ~~GEOTECHNICAL INVESTIGATION~~

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



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.

## 2.2

### 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 type of foundations and the allowable safe bearing capacity for different size 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.

All the work shall be carried out as per latest edition of the corresponding Indian standard codes.

## 2.3

### BORE HOLES

Fifteen nos. Bore holes (for new substation) of 150 mm diameter in accordance with the provisions of IS: 1892 up to 10meter depth into virgin soil or to refusal whichever occurs earlier shall be drilled. By refusal it shall mean that a standard penetration blow count (N) of 100 is recoded for 30 cm penetration. In case rock is encountered within five meter from existing ground level or three meter FGL, coring in all the boreholes shall be carried out 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 Contractor's laboratory without any damage or loss.

## **2.4 TRIAL PITS**

Trial pits shall be carried out at minimum one location per hectare as directed by the Employer. 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. 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.

## **2.5 ELECTRICAL RESISTIVITY TEST**

### **2.5.1 GENERAL**

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.

### **2.5.2 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.

### **2.5.3 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,

$\rho_a$  is the apparent resistivity of the soil in  $\Omega\text{-m}$

$R$  is the measured resistance in  $\Omega$

$a$  is the distance between adjacent electrodes in metres

$b$  is the depth of the electrodes in m

#### 2.5.4 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 electrodes spacing, increasing from 2m to 50m preferably in the steps of 2, 5, 10, 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 point shall be equally spaced direction from the centre of the test points shall be measured. These measurements shall be repeated for all test points.

#### NOTES:-

1. 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.
2. Average resistivity value of all eight directions shall be considered for design of earthing system.
3. Soil resistivity measurement may be done in dry season. Small

amount of water may be applied at electrodes for marking proper contact between the electrodes and soil.

## **2.6 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 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.

## **2.7 WATER SAMPLE**

Representative sample 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.

## **2.8 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.

## **2.9 LABORATORY TEST**

- 2.9.1. 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.

- 2.9.2. 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

- a) Visual and Engineering Classification
- b) Liquid limit, plastic limit and shrinkage limit for C-Ø soils.
- c) Natural moisture content, bulk density and specific gravity.
- d) Grain size distribution.
- e) Swell pressure and free swell index determination.
- f) California bearing ratio.
- g) Consolidated drained test with pore pressure measurement.
- h) 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.
- i) In case of rock samples following tests shall also be conducted:
  - Rock quality designation (RQD), RMR.
  - UCC test.
  - Point load index test.

## 2.10 TEST RESULTS AND REPORTS

- i) The Contractor shall submit the detailed report in four (4) copies wherein information regarding the geological detail of the site, summarized 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 test data shall bear the signatures of the Investigation Agency, Vendor and also site representative of Employer.
- ii) The report shall include, but not limited to the following:-
  - a) A plan showing the locations of the exploration work i.e. bore holes, trial pits, Plate load test etc.
  - b) 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.

Test results of field and laboratory tests shall be summarized strata wise as well as 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.

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

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

### **3.0 DRAWINGS**

Standard drawings have been developed for roads, road culverts, drains, cable trenches, cable trench crossing roads, sump, rain water harvesting, fire fighting pump house (Superstructure), control room building (Super structure), and fire tank by the Employer, as mentioned below, and are enclosed with the tender documents. These drawings are good for construction and are also available on POWERGIRD website. Additional prints if required can be downloaded from the website.

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

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

#### **3.1 Control room building**

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

#### **3.2 FIRE FIGHTING PUMP SHED & FIRE WATER TANK**

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

#### **3.3 TOWER & EQUIPMENT FOUNDATIONS**

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



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

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

### **3.4 Roads, road culverts and rail cum Road**

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

### **3.5 Drains**

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

### **3.6 External water supply from bore-well to fire water tank-Control Building**

(i) The drawing for the water supply from bore-well to fire water tank shall be developed by the Contractor. Water supply will be made available to the Contractor from a bore-well at suitable location within the sub-station. 80 mm dia GI pipe shall be provided by the Contractor from the connected by the Contractor to the roof water tank provided for the control room building.

(ii) The Contractor shall carry out all the external plumbing/erection works required for supply of water to the control room building and firewater tank.

(iii) 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

(iv) Bore well shall be in the scope of Contractor.

### **3.7 Stone spreading and antiweed treatment**

The layout of the area, where anti-weed treatment and stone spreading is



to be done, shall be developed by the Contractor during detailed engineering and the same shall be submitted to the employer for approval.

### **3.8 Cable Trenches**

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

### **4.0 EARTH WORK:**

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

### **4.1 EXCAVATION AND BACKFILL**

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

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

- b) Whenever water table is met during the excavation, it shall be dewatered and water table shall be maintained below the bottom of the excavation level during excavation, The excavation shall be kept free from water:-
  - i) When concrete and/or masonry works are in progress and till they come above the natural water level

- ii) Till the Employer considers that the concrete/ mortar is sufficiently set.
- c) Material unsuitable for foundations shall be removed and replaced by suitable fill material and to be approved by the Employer.
- d) Backfill material around foundations or other works shall be suitable for the purpose for which it is used and compacted. Excavated material not suitable or not required for backfill shall be disposed off in areas as directed by Employer up to a maximum lead of 2 km.
- e) Requirements regarding density / tests of backfilled earth shall be as specified in Field Quality Plan. The subgrade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor's density at OMC (optimum moisture content). Cohesion less material subgrade shall be compacted to 70% relative density (minimum).

#### **4.2 REQUIREMENT FOR FILL MATERIAL UNDER FOUNDATION**

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

#### **5.0 ANTIWEED TREATMENT & STONE SPREADING**

##### **5.1 Scope of work**

The Contractor shall furnish all labour, equipment and materials required for complete performance of the work in accordance with the drawings, specification and direction of the Employer.  
Stone spreading over 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 area shall be provided in case step potential without stone layer is not well within safe limits.

##### **5.2 General requirement**

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

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

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

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

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

- (b) Hardness

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

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

- (c) Flakiness Index

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

5.2.2 After all the structures/equipments are erected, antiweed treatment shall be

applied in the switchyard where ever cement concrete is to be done and the area shall be thoroughly de-weeded including removal of roots. The recommendation of local agriculture or horticulture department may be sought where ever feasible while choosing the type of chemical to be used. The antiweed chemical shall be procured from reputed manufacturers. The doses and application of chemical shall be strictly done as per manufacturer's recommendation. Nevertheless the effectiveness of the chemical' shall be demonstrated by the Contractor in a test area of IOMXIOM (appx) and shall be sprinkled with water at least once in the afternoon everyday after forty eight hours of application of chemical. The treated area shall be monitored over a period of two to three weeks for any growth of weeds by the Engineer-in-charge. The final approval shall be given by Engineer-in-charge based on the results.

- 5.2.3 Engineer-in-charge shall decide final formation level so as to ensure that the site appears uniform devoid of undulations. The final formation level shall however be very close to the formation level indicated in the approved drawing.
- 5.2.4 After antiweed treatment is complete, the surface of the switchyard area shall be maintained, rolled/compacted to the lines and grades as decided by Engineer-in-charge. The sub grade shall be consolidated by using half ton roller/surface vibrator with suitable water sprinkling arrangement to form a smooth and compact surface. The roller shall run over the sub grade till the soil is evenly and densely consolidated and behaves as an elastic mass.
- 5.2.5 In areas that are considered by the Engineer-in-Charge to be too congested with foundations and structures for proper rolling of the site surfacing material by normal rolling equipments, the material shall be compacted by hand rammer, if necessary. Due care shall be exercised so as not to damage any foundation structures or equipment during rolling 1 compaction.
- 5.2.6 The sub grade shall be in moist condition at the time the cement concrete is placed. If necessary, it should be saturated with water for not less than 6 hours but not exceeding 20 hours before placing of cement concrete. If it becomes dry prior to the actual placing of cement concrete, it shall be sprinkled with water and it shall be ensured that no pools of water or soft patches are formed on the surface.
- 5.2.7 Over the prepared sub grade, 75mm thick base layer of cement concrete in 1:5:10 (1 cement: 5 fine/coarse sand: 10 burnt brick aggregate 40mm nominal size) shall be provided in the area excluding roads, drains, cable trenches as per detailed engineering drawing. The Contractor shall have option to use graded stone aggregate 40mm nominal size in place of brick aggregate without any extra cost to employer. For easy drainage of water, the slope of 1:1000 is to be provided from the ridge to the nearest drain. The ridge shall be suitably located at the centre of the area between the nearest drains. The above slope shall be provided at the top of base layer of cement concrete in 1:5:10. A layer of cement slurry of mix 1:6 (1 cement: 6 fine sand) shall be laid uniformly over cement concrete layer. The cement consumption for cement slurry shall not be less than 150 kg for every 100 sq.m.
- 5.2.8 A final layer of 100mm thickness of stone aggregate of 40mm nominal size (conforming to clause 5.2.1) shall be spread uniformly over cement concrete layer after curing is complete.

## **6.0 ROADS AND CULVERTS**

- 6.1 All the roads in the scope of contract shall be 3.75 M wide excluding shoulder of width 1.2 M on either side of road. There shall be two types of road – concrete road and pre-cast paver block road.
- 6.2 Layout of the roads shall be as shown in the approved General Arrangement drawing for the substation. Adequate turning space for vehicles shall be provided and bend radii shall be set accordingly. Road to the Autotransformer/Reactor shall

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

- 6.3 The section details of roads is furnished in the drawing enclosed with tender document.
- 6.4 The location of culverts, diameter of RCC Hume pipes shall be decided by the Contractor during detailed engineering while finalising drainage layout. The invert level of Hume pipes of culverts shall match with the invert level of drain meeting the culvert.

## **7.0 FOUNDATION / RCC CONSTRUCTION**

### **7.1 General**

a). Work covered under this Clause of the Specification comprises the construction of foundations and other RCC constructions for switchyard structures, equipment supports, trenches, drains, jacking pad, pulling block, control cubicles, bus supports, Autotransformer/Reactors, marshalling kiosks, auxiliary equipments & systems buildings, tanks or for any other equipment or service and any other foundation required to complete the work. This clause is as well applicable to the other RCC constructions.

b). Reinforced cement concrete shall be of grade M-25 conforming to IS: 456. All the tests shall be conducted as per relevant Indian Standard Codes as mentioned in Standard field quality plan appended with the specification. Type and grade of cement shall conform to CPWD specification and reinforcement steel shall be thermo mechanically treated reinforcement bars of grade Fe 500 conforming to IS: 1786.

c). If the site is sloping, the foundation height will be adjusted to maintain the exact level of the top of structures to compensate such slopes.

The switchyard foundation's plinths and building plinths shall be minimum 300mm and 500mm above finished ground level respectively.

d). Minimum 75mm thick lean concrete (1:4:8) shall be provided below all underground structures, foundations, trenches etc. to provide a base for construction.

e). Concrete made with OPC grade 53 and PPC shall be carefully cured and special importance shall be given during the placing of concrete and removal of shuttering

f). The design and detailing of foundations shall be done based on the approved soil data and sub-soil conditions as well as for all possible critical loads and

the combinations thereof. The Spread footings foundation or pile foundation as may be required based on soil/sub-soil conditions and superimposed loads shall be provided.

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

## **7.2 DESIGN**

The following clauses shall be applicable only for the foundation 1 structure which the Contractor may have to design

a. All foundation shall be of reinforced cement concrete. The design and construction of RCC structures shall be carried out as per IS: 456. designed concrete mix of grade M-25 or higher as specified in BPS or section- Project of Technical Specification.

- b. Limit state method of design shall be adopted unless specified otherwise in the specification.
- c. thermo mechanically treated reinforcement bars of grade Fe 500 conforming to IS: 1786 shall be used as reinforcement. Detailing of reinforcement shall be done in accordance with IS: 2502 and SP: 34. Ductile Detailing shall conform to IS: 13920. Two layers of reinforcement (on inner and outer face) shall be provided for wall & slab sections having thickness of 150 mm and more. Clear cover to reinforcement shall be as per IS: 456 (latest).
- d. RCC water retaining structures like storage tanks, etc. shall be designed as uncracked section in accordance of the steel structure and or equipment and/or method. However, water channels shall be designed as cracked section with limited steel stresses as per IS: 3370 (Part I to IV) by working stress method.
- e. 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 IS Codes of foundation design. Detailed design calculations shall be submitted by the bidder showing complete details of piles/pile groups proposed to be used.
- f. Design shall consider any sub-soil water pressure that may be encountered



following relevant standard strictly.

- g. 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
- h. RCC columns shall be provided with rigid connection at the base.
- i. All sub-structures shall be checked for sliding and overturning stability during both construction and operating conditions for various combinations of loads. Factors of safety for these cases shall be taken as mentioned in relevant IS Codes or as stipulated elsewhere in the Specifications. For checking against overturning, weight of soil vertically above footing shall be taken and inverted frustum of pyramid of earth on the foundation should not be considered.
- j. Earth pressure for all underground structures 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.
- k. In addition to earth pressure and ground water pressure etc., a surcharge load of  $2T/Sq.m$  shall also be considered for the design of all underground structures including channels, sumps, tanks, trenches, substructure of any underground hollow enclosure etc., for the vehicular traffic in the vicinity of the structure.
- l. Following conditions shall be considered for the design of water tank in pumps house, channels, sumps, trenches and other underground structures:
  - i) 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).
  - ii) Full earth pressure, surcharge pressure and ground water pressure from Outside and no water pressure from inside.
  - iii) Design shall also 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.
- m. 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.
- n. 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.

- o. The foundation 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.
- p. 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.

**q. Transformer and Reactor Foundation:**

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

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. 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.

The contractor shall provide a pylon support system for supporting the fire Fighting

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 volume in the Autotransformer/Reactor.

The minimum height of the retaining walls of pit shall be 20cm 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 sunp pit. While designing the oil collection pit, the movement of the autotransformer / reactor must be taken into account.

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 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- 1999. 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.



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.

**r. FIRE PROTECTION WALLS**

Fire protection walls shall be provided, if required.

The firewall shall have a minimum fire resistance of 4 hours. The walls of the building, which are used as firewalls, shall also have 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.

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

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

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

**7.3 ADMIXTURES & ADDITIVES**

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

placing operations and shall only be approved as an aid to overcoming unusual circumstances and placing conditions.

- d). The water-reducing set-retarding admixture shall be an approved brand of Ligno-sulphonate type admixture.
- e). The water proofing cement additives shall be used as required / advised by the Employer.

## **8.0 GIS Building**

GIS building shall be of pre-engineered steel structure. The building Consists of GIS hall, Room for control, protection & communication panels And AHU room. Dimensions of the building shall be as specified in bib Price schedule (BPS). The base plate of steel columns shall be mounted On the RCC foundation by means of foundation bolts at plinth level. The Building consists of brick up to a height of 3.0M (approximate) from Plinth and above brick work, PUF insulated panels shall be provided.

Foundation, brickwork, doors, windows in brickwork, plaster, painting of Plastered surface, glazed partitions are in the scope of contract.

Pre-engineered building consisting of steel work, windows, ventilators & Other openings placed above brick work in PUF panels and rolling shutter Shall be in the PEB contractor's scope under separate package.

### **8.1 INTERNAL FINISH SCHEDULE**

The finishing schedule is given in subsequent clauses and table-1.

### **8.2 FLOORING**

Flooring in various rooms GIS hall shall be as per detailed schedule given In table -1.

### **8.3 WALLS**

In GIS building and the attached relay room 230mm thick brick brick wall shall Be provided a height of 3.0M (approximate) from plinth.

### **8.4 CABLE TRENCH IN GIS HALL**

All cable trenches in 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'2013.

### **8.5 EXTERNAL PLASTER AND PAINTING**

External plaster 18mm thick shall be of 1:6 cement sand plaster in two Layers. External surface of the GIS building (brick wall portion) shall be Painted with Premium acrylic smooth exterior paint with silicon additives Over and including priming coat of exterior primer as per item 13:47.1 of DSR'2013.

## 8.6 INTERNAL FINISH SCHEDULE

Internal finish Schedule for GIS hall is given in Table – 1 below:

**Table - 1**

S.No.	LOCATION	FLOORING & SKIRTING 150MM HIGH	WALL(INTERNAL)	CEILING	DOOR, WINDOWS & VENTILATOR
1.	GIS Hall	62mm thick cement Concrete flooring with Metallic hardener Topping (DSR item code 11.5)	Oil bound washable Distemper (DSR Item 13.41.1) on Smooth surface Applied with plaster Of paris putty (DSR Item 13.26)	-----	Windows/ventilator shall be of power coated aluminium with 5.5 thick glazing. All doors shall be flush door shutters with powder coated aluminium frame.
2.	Panel/Relay Room	Virifield tiles 8mm thick Size 600 x 600mm	Premim Acrylic emulsion paint on smooth surface applied with plaster of paris (2 mm thick)	False Ceiling	Windows shall be of powder Coated aluminium with 5.5mm Thick glazing. All doors shall be Glazed powder coated aluminium doors with 5.5mm thk. Glazing
3.	AHU Room	62mm thick cement Concrete flooring with Metallic hardener Topping (DSR item code	Premium Acrylic Emulsion paint on Smooth surface Applied with plaster	Acrylic emulsion paint over a coat of cement primer on smooth surface applied with	Windows/ventilator shall be of Powder coated aluminium with 5.5mm thick glazing. All doors Shall be flush door shutters with
S.No.	LOCATION	FLOORING & SKIRTING 150MM HIGH	WALL(INTERNAL)	CEILING	DOOR, WINDOWS & VENTILATOR
		11.5	Of paris( 2 mm thick)	Readymade putty 1 mm thick (DSR item no. 13.80 & 13.83)	Powder coated aluminium frame.

## 8.7 DOORS AND WINDOWS

The details of doors and windows of the GIS building shall be as per finish schedule table -1 conforming to relevant IS code.

## 8.8 PARTITION

Partitions shall be made of power coated aluminium frame provided with 5.5 mm thick clear glass or pre- laminated board depending upon the Location of partition.

## 8.9 FALSE CEILING

Fifteen millimeter thick densified tegular edged eco friendly light weight

Calcium silicate false ceiling as per item 12.53 of DSR'2013 shall be Provided in the areas specified in Finish Schedule.

## 9.0 BUILDINGS (AS PER EMPLOYER'S DRAWING)

This clause is applicable for Buildings, which are to be constructed as per Drawings provided by employer such as control room building, switchyard panel room and fire water pump house with fire water tank. Standard architectural drawings of buildings covered in the scope, are enclosed with the tender documents. 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.

The details like size, finish details etc shall be as mentioned in the drawings enclosed with tender documents. However, descriptions of some of the items to be used in the buildings are given below:

Windows/ventilators shall be sliding or openable or partially openable/partially fixed or fixed type. The type of windows shall be as per approved drawings or to be decided during detailed engineering.

Powder coated aluminium (minimum thickness of powder coating 50 micron) for doors, windows, ventilators, fixed glazing and partitions with extruded built up standard tubular sections/ appropriate sections of approved make conforming to IS: 733 and IS: 1285 shall be used including fixing with dash fasteners, hinges, pivots, glazing plate, EPDM rubber/ neoprene gasket, snap beading, cleat angles, handles, C.P. brass / stainless steel screws, filling up the gaps at junctions etc required to complete the work as per the directions of Engineer-in-charge. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically.

The minimum sizes of aluminum sections are tabulated below. Contractor may also use higher thickness aluminium section without any financial implication to POWERGRID.

Aluminium section number mentioned here are of Jindal Aluminum for reference only. Contractor shall source aluminium sections from any approved manufacturer.

<b><u>DOORS</u></b>	
<b>Description</b>	<b>Section nos. and its weight/meter</b>
Frame plain	14057 (0.828 kg/m)
Shutter top	19582 (1.300 kg/m)
Shutter-bottom	19517 (2.376 kg/m)
Shutter-vertical	19560 (1.417 kg/m)
Shutter-middle	20002 (2.779 kg/m)
<b><u>Door with top fix ventilator</u></b>	
<b>Description</b>	<b>Section nos. and its weight/meter</b>
Frame plain	14057 (0.828 kg/m)

Frame –single groove	20059 (1.394 kg/m)		
Frame-double groove	20081 (1.456 kg/m)		
Shutter top	19582 (1.300 kg/m)		
Shutter-bottom	19517 (2.376 kg/m)		
Shutter-vertical	19560 (1.417 kg/m)		
Shutter-middle	20002 (2.779 kg/m)		
<b><u>Door cum fixed glazing and Door cum partition.</u></b>			
<b>Description</b>	<b>Section nos. and its weight/meter</b>		
Frame plain	14057 (0.828 kg/m)		
Frame –single groove	20059 (1.394 kg/m)		
Frame-double groove	20081 (1.456 kg/m)		
Shutter top	19582 (1.300 kg/m)		
Shutter-bottom	19517 (2.376 kg/m)		
Shutter-vertical	19560 (1.417 kg/m)		
Shutter-middle	20002 (2.779 kg/m)		
<b><u>Door cum fixed glazing and openable window</u></b>			
<b>Description</b>	<b>Section nos. and its weight/meter</b>		
Frame plain	14057 (0.828 kg/m)		
Frame –single groove	20059 (1.394 kg/m)		
Frame-double groove	20081 (1.456 kg/m)		
Shutter top	19582 (1.300 kg/m)		
Shutter-bottom	19517 (2.376 kg/m)		
Shutter-vertical	19560 (1.417 kg/m)		
Shutter-middle	20002 (2.779 kg/m)		
Window frame	20903 (0.522 kg/m)		
Window glazed shutters	20719 (0.575 kg/m)		
Window mullion	20720 (0.729 kg/m)		
Window glazing clip	19376 (0.188 kg/m)		
<b><u>Sliding Window</u></b>			
<b>Description</b>	<b>Series-2 track</b>	<b>Series-3 track</b>	<b>Series-4 track</b>
Shutter Top & bottom	20506 (0.717 kg/m)	20506 (0.717 kg/m)	20506 (0.717 kg/m)
Shutter side	20507 (0.642 kg/m)	20507 (0.642 kg/m)	20507 (0.642 kg/m)
Shutter inter lock	21145 (0.985 kg/m)	21145 (0.985 kg/m)	21145 (0.985 kg/m)
Frame bottom	21146 (1.308 kg/m)	21148 (1.842 kg/m)	20797 (1.667 kg/m)
Frame top & side	21147 (1.073 kg/m)	21149 (1.539 kg/m)	20796 (1.434 kg/m)

<b><u>Partial Openable/partially fixed window</u></b>	
<b>Description</b>	<b>Section nos. and its weight/meter</b>
Main frame	20903 (0.522 kg/m)
Glazed shutters	20719 (0.575 kg/m)
Mullion	20720 (0.729 kg/m)
Glazing clip	19376 (0.188 kg/m)

1. 12mm cement plaster of mix 1:6 (1 cement: 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 (1 cement: 6 fine sand)
2. 6mm cement plaster of mix 1:3 (1 cement: 3 fine sand) to all ceiling.
3. External plaster in two coats – 18mm Cement plaster in two coats under layer 12mm thick cement plaster 1:5 (1 cement: 5 coarse sand) finished with a top layer 6mm thick cement plaster (1 cement: 6 fine sand).
4. 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 and including water thinnable priming coat with cement primer.
5. Providing and applying white cement based putty of average thickness one mm, of approved brand and manufacture, over the plaster surface to prepare the surface even and smooth complete.
6. Painting with synthetic enamel paint of approved brand and Manufacture of required colour to given an even shade shall be provided on the steel doors and rolling shutter in various buildings as specified in the drawings. Two or more coats over an under coat of suitable shade with primer paint of approved brand and manufacture.
7. Deleted
8. 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
9. 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, for skirting 1:4 (1 cement: 4coarse sand) including grouting the joints with white cement and matching pigments etc., complete.
10. 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 cement mortar 1:4 (1 cement: 4coarse Sand) including grouting the joints with white cement and matching pigments etc., complete.

11. Ceramic glazed wall tiles of 1<sup>st</sup> 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 skirting, risers of steps and 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.
12. 230mm thick brickwork shall be provided with cement mortar 1:6 (1 cement: 6 coarse sand). Half brick (115mm thick) work masonry Shall be provide with cement mortar 1:4 (1cement: 4coarse sand) And two no 6mm dia MS bar at every third course. FPS Bricks of Clay/Fly ash used shall be of class-75.
13. Anti termite treatment shall be carried out for all buildings as per DSR item no. 2.34 & 2.35.
14. M.S. rolling shutters as per drawing shall be provided and fixed interlocked together through their entire length and jointed together at the end by end locks mounted on specially designed pipe shaft with brackets along with ball bearing for rolling shutter, side guides and arrangements for inside and outside locking with push & pull operation including the cost of providing and fixing necessary 27.5 cm long wire springs grade No. 2 and M. S laths with 1.25 mm thick top cover. In case area of rolling shutters exceeds 10 sq.m, mechanical device chain and crank operation for operating shutters shall be provided.
15. 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.
16. 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, 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 / paneling, C.P. brass/ stainless steel screws including glazing and fittings as specified. All doors except for toilet and kitchen shall have 100mm 6 lever CP Brass mortice latch and lock with a pair of lever



handle. Sliding door bolt of ISI marked (300x16mm) size shall be provided for toilet, kitchen and main door of control room/residential buildings. All works shall be carried out as per drawings.

17. Cement based water proofing treatment of roofs, balconies, terraces etc. shall be provided with average thickness of 120mm and minimum thickness at Khurra as 65mm and laid 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.
18. unplasticised rigid PVC rain water pipes of 110mm dia shall be Provided and fixed on the wall face conforming to IS:13592 type A as per drawing 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..
19. unplasticised PVC Moulded fittings/accessories including 110mm bend and 110mm 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.

20. unplasticised PVC pipe clips of approved design shall be provided and fixed to unplasticised 110mm PVC rain water pipes by means 50x50x50mm hard wood plugs, screwed with MS screws of required length including cutting brick work and fixing in cement mortar 1:4 ( 1 cement: 4 coarse sand) and making good the wall etc.
21. Double action hydraulic floor spring of approved brand and manufacture IS: 6315 marked "hardwyn" make (Model 3000) or equivalent 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.
  - a. Main Entrance to Control Room Building
  - b. Substation in charge room.
  - c. Office
  - d. Control room
22. Plinth protection 50 mm thick of cement concrete 1:2:4 (1 cement : 2 ce 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.
23. Coloured vitreous china pedestal type water closet (European type) shall be provided with seat and lid, 10 litre low level vitreous china flushing cistern & C.P. flush bend with fittings and C.I. brackets, 40mm flush bend, overflow arrangement and mosquito proof coupling of including painting of fittings and brackets, cutting and making good the walls and floors wherever required.
24. Deleted
25. All urinals shall be coloured vitreous china flat back half stall urinal of 580x380x350mm with 10 litre PVC automatic flushing cistern, parryware/ Hindware/ Seabird/ Orient (Coral) with fittings, standard size C.P. brass) with waste fitting as per IS: 2556 C.I. trap with outlet grating and other couplings in C.P. brass including painting of fittings and cutting and making good the walls and floors wherever required.
26. Following fittings shall be provided in the toilet as per the drawings:
  - i) Toilet paper roll holder.
  - ii) Double type coat & hat hooks with flanges, fixed to wall / shutter, etc. with necessary screws, washers & plugs.

- iii) CP liquid soap holder of approved make fixed with each wash basin to the wall with necessary CP brackets, CP screws, washers, plugs etc.
  - iv) 100mm dia vitreous chinaware half round channel of approved make fixed to correct grade, level, opening for floor trap below urinals set in CM 1:3 & pointed using white cement etc.
  - v) CP brass bib cock 15mm nominal bore of approved quality conforming to IS: 8931.
  - vi) CP press angle valve of 15mm nominal and fixed in position for positions for basin and cistern points of approved quality conforming IS :8931.
  - vii) Best quality marble partition slab provided and fixed in position for urinals, of size 610x1150mm, 20mm thick, polished on both sides & machine cut, exposed corners rounded etc.
  - viii) 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.
  - ix) 6mm thick beveled edge mirror 1000x600mm shall be provided and fixed mounted on 12mm thick water proof plywood backing and hardwood beading all-round and mirror fixed to the backing with 4 nos. of CP cap screws & washers, including fixing the mirror to the wall with necessary screws, plugs & washers etc, with each wash basin.
31. Internal and External water supply works:
- a) All CPVC pipes 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.

27. 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 100mm. Top diameter, 160 mm bottom dia and 180 mm deep (inside) with chained lid and RCC top slab 1:2:4 mix (1 cement :2 coarse sand: 4 graded stone aggregate 20 Mm nominal size) necessary excavation foundation concrete 1:5:10 (1 cement : 5 fine sand : 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.
28. Polyethylene water storage tanks conforming to ISI: 12701 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 2x1000 litres for control room
29. PVC floor traps of self cleansing design shall be provided & fixed in position with outlet size of 75mm diameter 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, providing & fixing of top tile & strainer of CP or PVC on top of the trap etc.
30. square-mouth SW gully trap grade 'A' 100x100mm size P type with FPS Bricks class designation 75 shall be provided and fixed complete with CI grating brick masonry chamber with water tight C.I. cover with frame of 300x300mm size (inside) the weight of cover to be not less than 4.5 Kg and frame to be not less than 2.70 Kg as per standard design.
31. Brick Masonry road gully chamber of 50x45x60cm shall be provided with brick with cement mortar 1:4 including 500x450mm pre cast RCC Horizontal/vertical grating with frame complete.
32. Glazed stoneware pipes of 150mm diameter grade 'A' shall be provided, laid and jointed with stiff mixture of cement mortar in the proportion of 1:1 ( 1 fine sand ) including testing of joint etc. complete.
33. Cement concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) shall be provided and laid around S.W pipes including bed concrete.
34. 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 coarse sand : 4 graded stone aggregate 20 mm nominal size ) foundation concrete 1:4:8 mix (1 cement : 4 coarse sand :8 graded

stone aggregate 40 mm nominal size ) inside plastering 12 mm thick 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.

- 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./fly ash bricks with class designation 75.
  - b) Inside size shall be 120 x 90 cm and 90 cm or more deep including CI cover 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.
35. MS foot of 20 x 20mm square rest shall be provided and fixed in manholes with 20 x 20 x 10 cm cement concrete blocks 1:3:6 (1 cement :3 coarse sand :6 graded stone aggregate 20 mm nominal size) as per standard design.
36. GS corrugated sheets of 0.80 mm thick with zinc coating not less than 275 gm/sqm. 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.
37. Wash basin flat back wash basin (550x 400mm) shall be provided with CI. Brackets 15mm C.P. brass pillar taps, close hole basin mixer 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.
38. All doors except toilet and kitchen shall have 100mm 6 liver mortice

**10.0 MODE OF MEASUREMENT** This clause (Clause No. 10) is not applicable for this project

**10.1 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. The quantity of excavation for foundations of towers, equipment. structures, all transformers, firewall, cable trenches, water tank, reactors, buildings, marshalling kiosks, underground water tank 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, 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. the quantity shall be measured in cubic metres.

## **10.2 PCC**

Providing and laying Plain Cement Concrete of all type 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.

### **10.2.1 Deleted**

10.2.2 PCC 1:2:4 (1 cement: 2 coarse sand: 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, etc. as indicated in the drawings.

10.2.3 PCC 1:3:6 (1 cement : 3 fine sand : 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.

10.2.3 PCC 1:4:8 (1 cement : 4 fine sand : 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 foundation etc. as indicated in the drawings.

10.2.4 PCC 1:5:10 (1 cement: 5 fine sand: 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 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.

## **10.3 RCC**

Measurement of reinforced cement concrete at all locations shall be made and shall include all leads lifts, formwork, grouting of pockets and underpinning, but shall exclude reinforcement. This shall also include precast 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.

#### **10.4 Steel Reinforcement**

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 tones 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.

#### **10.5 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.

#### **10.6 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. Quantity shall be measured in MT.

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 / epoxy zinc phosphate primer etc wherever specified, setting of all types of embedment in concrete, etc. Gratings in transformer / reactor foundations and its supports shall be painted with epoxy zinc phosphate primer.

Steel required for foundation bolts & fasteners (other than towers and equipment support structures), doors, windows, ventilators, louvers, rolling shutters, chain link fencing, barbed wires, 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, etc. shall not be considered for payment and measurements.

#### **10.7 Roads**



The measurement of concrete or pre cast paver block road shall be made on the basis of area in square metres (m<sup>2</sup>) of top completed surface of the road and shall be deemed to include all items such as excavation, compaction, rolling, watering, WBM, sub-base course, shoulder, kerb stone etc. complete in all respect. However PCC, RCC and steel reinforcement shall be measured under respective clauses mentioned above.

#### **10.8 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.

#### **10.9 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.

#### **10.10 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 excavation, laying, back filling, jointing, brickwork, plastering etc complete in all respect but excluding concrete which will be measured and paid separately under respective items.

#### **10.11 Buildings**

**a) Control Room Building/Auxiliary Building/FFPH:** Payment for this item shall be made on plinth area basis for each building including internal foundations, cable trenches, internal & external finishes, etc complete in all respect. However, the quantity of excavation, PCC, RCC, reinforcement steel and steel inserts in foundation & cable trenches shall be measured and paid separately as per clause nos. 10.1, 10.2, 10.3, 10.4 & 10.6 described above. Plinth area shall be calculated based on IS 3861-2002.

**b) GIS Buildings (Pre-engineered Buildings):** All items of civil works shall be measured and paid. Excavation, PCC, RCC, reinforcement steel and steel inserts in foundation & cable trenches shall be measured and paid as per clause nos. 10.1, 10.2, 10.3, 10.4 & 10.6 described above. All other items shall be measured and paid as per CPWD specification.

**c) Internal Electrification and Fire Fighting:** Payment for Internal



electrification as well as internal Fire fighting works is not included in items covered in clause 10.11 a, & b.

**10.12 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 excavation, compaction, rolling, watering, WBM etc. complete as per drawing but excluding concrete, steel reinforcement, structural steel and rails.

**10.13 Septic Tank and Soak Pit for Control room building**

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 excavation, 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 clause no. 10.2, 10.3 & 10.4 mentioned above.

**10.14 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 excavation, 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 clause no. 10.2, 10.3 and 10.4 mentioned above.

**10.15 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 GI pipe of various diameters. It shall include all the items such as excavation, 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.

**10.16 External Sewage System of the control room building shall be measured diameter wise in running meters. It shall include all the items such as excavation, 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 extra cost implicated to Employer.**

#### **10.17 Cable Trenches**

Various items like earthwork, PCC, RCC, reinforcement steel and miscellaneous steel required for construction of cable trenches shall be measured under respective clauses mentioned above.

#### **10.18 Drains**

For RCC drains: Various items like earthwork, PCC, RCC, reinforcement steel and miscellaneous steel required for construction of drains shall be measured under respective clauses mentioned above.

For Brick drains: the items PCC (1:2:4 and 1:4:8) for drains shall be measured under respective clauses mentioned above. All other items required for completion of drains shall be deemed to be included in the rate of items quoted for drain.

#### **10.19 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.

#### **10.20 Pile Foundation**

- a). 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, installing etc complete in all respect except for concrete and reinforcement steel which will be paid separately under respective items.
- b). 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 clause 10.3 & 10.4 and boring installing including casing and bentonite treatment 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.

#### **10.21 Contractor Designed Foundations**

Contractor designed foundations shall be measured and paid as per clause 10.1, 10.2, 10.3, 10.4, 10.5 and 10.6 unless otherwise specified.

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

**11.0 MISCELLANEOUS GENERAL REQUIREMENTS**

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

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

- 11.3 All mild steel parts used in the fire fighting water tank and under ground water tank shall be hot-double dip galvanised. The minimum coating of the zinc shall be 750 gm/sq. m. for galvanised structures and shall comply with IS:2629 and IS:2633. Galvanizing shall be checked and tested in accordance with IS: 2633. The galvanizing shall be followed by the application of an etching primer and dipping in black bitumen in accordance with BS: 3416.

- 11.4 FPS Bricks of clay having minimum 75 kg/cm<sup>2</sup> compressive strength can only be used for masonry work. Contractor shall ascertain himself at site regarding the availability of bricks of minimum 75 kg/cm<sup>2</sup> compressive strength before submitting his offer. However, Contractor can propose to use of fly ash based bricks/ hollow concrete blocks or solid concrete blocks of compressive strength not less than 75kg/cm<sup>2</sup>. for which no extra payment shall be made.

- 11.5 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.

- 11.6 The material specification, workmanship and acceptance criteria shall be as per approved standard Field Quality Plan attached with this document. In case certain item is not covered in FQP, it shall be constructed as per CPWD specification.

- 11.7 Ready mix concrete pertaining to M25 grade of reputed manufacturer such as Lafarge, ACC, Ultra Tech, RMC Readymix India etc. or manufacturer of similar reputé shall also be accepted for use in construction activity. Materials specification shall conform to IS: 456 and acceptance criteria of readymix concrete shall be as per IS: 4926-2003.

- 11.8** 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.

**12.0 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.

**13.0 STATUTORY RULES**

- 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.
- Statutory clearance and norms of State Pollution Control Board shall be followed as per Water Act for effluent quality from plant.
- 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.
- All building/construction materials shall conform to the best quality specified in CPWD specifications if not otherwise mentioned in this specification.
- All tests as required in the standard field quality plans have to be carried out.

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 1 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
1.	Detailed Soil Investigation	a) Bore log	1. Depth of bore log 2. SPT Test 3. Collection of samples	As per POWERGRID Specification	Contractor	100% at Field	To witness 20% at Field	Site Engineer
		b) Tests on samples	As per tech. Specs.	As per POWERGRID Specification	Contractor (Testing in POWERGRID accepted Lab)	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 Annex-6
2.	Earth Work (site leveling)							
		1. Mandatory testing for filling						
			1. Proctor compaction test for maximum dry density	IS:2720(part-7) & Specification	Contractor from Powergrid approved Lab.	One sample per 25000 Cu. m. 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
		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.	do	do



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 2 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Agency		
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 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 accepted lab	Review of 100% MTC's and one sample for every Batch No. 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 main producers directly or through the authorized dealers who can produce MTC from main producers with traceability. Refer COV in POWERGRID web site, for List of Main Producers of Re-enforcement Steel.	Contractor	As proposed by contractor.	Material shall be supplied from Main producers / authorized dealers.	Site in charge.

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 3 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
			2. Physical and Chemical analysis test	As per annexure-2 of this FQP	Contractor to submit MTC	100% MTC's  One sample* / 500 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 500MT.	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
	# 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 fdn.	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 damages rusting pitting etc	POWERGRID specification and approved drawing	Contractor	100%	random	Site Engr
		2.c) Structural steel used in cable trenches, transformer	Source to be proposed by contractor.	POWERGRID Specification	Contractor	As proposed by contractor	To verify documents.	



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 4 of 26

S. No.	Description of Activity	& reactor fdn.	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
						Agency	Extent		
				1. Dimensional check	POWERGRID specification and approved drawing	Contractor	100%	random	Site Engr
				2. Visual check for damages rusting pitting etc.	POWERGRID specification and approved drawing	Contractor	100%	random	Site Engr
				3. Visual check for welding defects primer coating and painting/ galvanizing as applicable	POWERGRID specification and approved drawing	Contractor	100%	Random	Site Engr
				4. Physical properties of Structural steel	IS:2062 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 Engr
			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 accepted 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.

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 5 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
			2. Physical tests	As per document at Annexure-3 of this FQP	Samples to be taken jointly and tested in POWERGRID accepted lab	One sample per 500 cum or part thereof per source, Samples to be tested by Contractor in POWERGRID accepted lab.	100% review of lab test results. Out of these 100% samples, POWERGRID shall witness at TPL, 5 samples selected at random, spread during the overall execution period of contract.	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 accepted 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 accepted lab	One sample per 500cum or part thereof per source, Samples to be tested by Contractor in POWERGRID accepted lab.	100% review of lab test results. Out of these 100% samples, POWERGRID shall witness at TPL, 5 samples selected at random, spread during the overall execution period of contract.	Site In charge
		5. Water	1. Cleanliness	POWERGRID Specification (Water shall be fresh and clean)	Contractor	100% visual check at Field	Verification at random	Site Engineer



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 6 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
			2. PH Value	- do -	Contractor	One sample per source	100% review of the test results Ph value not less than 6	Site Engineer
		6.Finishing materials of building	Physical verification of Different items as per specification	As per Spec.	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	Appd. Drgs.	Contractor	100% at Field	100% check by POWERGRID	Site Engr.
		2. Stub setting/Setting of Foundation Bolts, Embedments etc.	1) Centre Line 2) Diagonals 3) Level of stubs./ Foundation bolts	-do-	-do-	-do-	-do-	** -do-
				-do-	-do-	-do-	-do-	** -do-
				-do-	-do-	-do-	-do-	** -do-

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 7 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
		3. Reinforcement steel	Placement	Bar bending schedule	-do-	-do-	-do-	*-At least 5% locations shall be cross verified by immediate Reporting officer/ Site In charge, at Random with respect to stub setting and reinforcement steel placement
b) During concreting		1. Workability	Slump test	Range 25 mm to 75 mm refer document at Annexure-5 of this FQP	Contractor	Minimum 01 sample per day	20% check at random	Site Engr.



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 8 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Agency		
		2. Concrete Strength	Cubes Comp Strength	CPWD SPEC as referred in document at annexure-5 of this FQP	Contractor Casting of cubes at site. Cubes to be tested for 28 days strength at POWERGRID appd. Lab /POWERGRID Lab/At site ( if testing machine installed by contractor is duly calibrated by NABL Lab.) Cubes at 100% location are to be taken in presence of POWERGRID officials.	One sample of 3 cubes for every 20 Cum or part thereof. (Mini. Qty. required for testing is 5 cu. m. for each day of concrete).	100% review of Lab test results. Cubes at 100% location are to be taken in presence of POWERGRID officials. Normally testing shall be carried out at the Cube Testing Facility installed at POWERGRID premises, in the witness of POWERGRID. Alternatively, samples shall be tested at 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. Further, POWERGRID to witness testing on 20% samples and also to review 100% test results.	Site Engineer. 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 Lab, 100% witnessed by POWERGRID representative.
c) Backfilling		Watering & Ramming for compaction	a) Visual	POWERGRID Spec	Contractor	100%	Random	Site Engr.





## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 9 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
			b) Compaction Test	POWERGRID Spec	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
4.	Pile foundations							
5.	Brick Masonry	a) 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

REFER SFQP OF SWITCHYARD PILE WORK

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 10 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
			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) Mortar Mix	Cement sand Proportion	As per POWERGRID Spec	Contractor	100%	random	Site Engr
6.	P.C.C	Grade, thickness, plan dimension	completeness	IS:456 and POWERGRID approved foundation drawings & specification	Joint Inspection by POWERGRID and CONTRACTOR	For all locations	Joint Inspection by POWERGRID and CONTRACTOR	Site Engr.
7.	PLASTERING							
		1.Plastering	thickness and evenness	As per POWERGRID Spec.	Contractor	100%	Random	Site Engr
		2. ingredients	Mortar Mix/Proportion	As per POWERGRID Spec.	Contractor	100%	Random	Site Engr
8.	Switchyard earthing							
		1. Check for dimension of earth mat	Physical check	POWERGRID spec & approved drawings	contractor	100%	Random	Site Engr



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 11 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
		2. Depth of excavation	Physical check	POWERGRID spec & approved drawings	Contractor	100%	Random	Site Engr
		3. Check for weld joints and anti corrosion treatment	Physical check	POWERGRID spec & approved drawings	Contractor	100%	Random	Site Engr
9.	Site surfacing							
		1. Leveling, Level & Height & evenness	Physical Check	POWERGRID spec & approved drawings	Contractor	100%	Random	Site Engr
		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 coarse/fine sand:10 burnt brick aggregates) -Burnt brick aggregate of nominal size 40 mm	Completeness  Grading	POWERGRID specifications  As per Annexure-8	Joint Inspection by POWERGRID and Contractor	100%	Random	Site Engr
		4. 20/40mm stone aggregate	Grading	IS 383, IS 2386 and POWERGRID Speci. 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



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 12 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
		5. Resistivity of 20/40mm 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 20/40mm stone layers as applicable	Physical	POWERGRID spec & approved drawings	Contractor	100%	Random	Site Engineer
10	Road (WBM layers)							
		1. Alignment & Level	Physical check	Power grid spec & approved drawings	Contractor	100%	100%	Site In charge
	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 accepted 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 200 cum or part thereof per source	100% review of lab test results	Site In charge





## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 13 of 26

S. No.	Description of Activity	Items to be Checked	Tests/Checks to be done	Ref. documents	Check/Testing		Counter Check/Test by POWERGRID	Accepting authority in POWERGRID
					Agency	Extent		
		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 accepted 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 25 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 Engr
		E) Laying of base Course	Physical check	As per CPWD spec clause 17.8.1	Contractor	100%	Random	Site Engr
11	Drain	Alignment and invert level	Physical	POWERGRID spec and approved drawing	Contractor	100%	Random	Site Engr

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 14 of 26  
Annex-1  
(Sheet 01 of 03)

## 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	Ordinary Portland Cement 43 grade as per IS 8112	Ordinary Portland Cement 53 grade as per IS 12269	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/gm.	Specific surface area shall not be less than 225 sq.m. per Kg or 2250 Cm2/gm.	Specific surface area shall not be less than 225 sq.m. per Kg or 2250 Cm2/gm.	Blaine's air permeability method as per IS 4031 (Part-2) / Sieve analysis as per IS 4031 (part-3)
(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)	72 ± 1 hour : Not less than 23 Mpa ( 23 N/mm <sup>2</sup> ) 168 ± 2 hour : Not less than 33Mpa ( 33 N/mm <sup>2</sup> ) 672 ± 4 hour : Not less than 43 Mpa ( 43 N/mm <sup>2</sup> )	72 ± 1 hour : Not less than 27Mpa (27 N/mm <sup>2</sup> ) 168 ± 1 hour : Not less than 37Mpa ( 37 N/mm <sup>2</sup> ) 672 ± 1 hour : Not less than 53 Mpa ( 53 N/mm <sup>2</sup> )	As per IS 4031 (Part-6)
(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)  -do-
(iv)	Soundness	Un-aerated cement shall not have an expansion of more than 10mm when tested by Le Chatelier and 0.8% by Autoclave test.	Un-aerated cement shall not have an expansion of more than 10mm when tested by Le Chatelier and 0.8% by Autoclave test	Un-aerated cement shall not have an expansion of more than 10mm when tested by Le Chatelier and 0.8% by Autoclave test.	Le Chatelier and Autoclave test as per IS 4031 (Part-3)



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 15 of 26

Annex-1  
(Sheet 02 of 03)

S. No.	Name of the test	Ordinary Portland Cement 33 grade as per IS 269	Ordinary Portland Cement 43 grade as per IS 8112	Ordinary Portland Cement 53 grade as per IS 12269	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. 4.00%	c) Insoluble residue, percentage by mass Max. 2.00%	c) Insoluble residue, percentage by mass Max. 2.00%	
		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 <sub>3</sub> ), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5 or less and greater than 5 respectively.	e) Total sulphur content calculated as sulphuric anhydride (SO <sub>3</sub> ), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5 or less and greater than 5 respectively.	e) Total sulphur content calculated as sulphuric anhydride (SO <sub>3</sub> ), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percent by mass is 5 or less and greater than 5 respectively.	
		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 5 percent	

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 16 of 26

### Annex-1 (Sheet 03 of 03)

S. No.	Name of the test	Remarks
2.	POZZOLANA PORTLAND CEMENT AS PER IS 1489	
a)	Physical tests	Specific surface area shall not be less than 300 sq.m. per Kg. or 3000 Cm <sup>2</sup> /gm
	i) Fineness	a) 72 ± 1 hour : Not less than 16 Mpa (16 N/mm <sup>2</sup> )
	ii) Compressive strength	b) 168 ± 2 hour : Not less than 22 Mpa (22 N/mm <sup>2</sup> )
		c) 672 ± 4 hour : Not less than 33 Mpa (33 N/mm <sup>2</sup> )
	iii) Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes
	iv) Soundness	Un-aerated cement shall not have an expansion of more than 10mm 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 MTCC only
	b) Insoluble material, percentage by mass x + 4 (100-x)/100 where x is the declared % of pozzolana in the PPC	-do-
	c) Total sulphur content calculated as sulphuric anhydride (SO <sub>3</sub> ), percentage by mass not more than 3.0	-do-
	Total loss on ignition shall not be more than 5 percent	



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 17 of 26  
Annex-2

### ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR REINFORCEMENT STEEL AS PER IS 1786-1985 Edition-4.3 (2004-12)

S. No.	Name of the test	Fe 415	Fe 500
i)	<b>Chemical analysis test</b>		
	Carbon	0.30 Percent Maximum	0.30 Percent Maximum
	Sulphur	0.060 Percent Maximum	0.055 Percent Maximum
	Phosphorus	0.060 Percent Maximum	0.055 Percent Maximum
	Sulphur & Phosphorus	0.11 Percent Maximum	0.105 Percent Maximum
ii)	<b>Physical tests</b>		
	a) Tensile Strength Minimum	10% more than actual 0.2% proof stress but not less than 485 N/Sq.mm.	8 % more than actual 0.2% proof stress but not less than 545 N/Sq.mm
	b) 0.2% of proof stress/Yield stress Minimum, N/mm <sup>2</sup>	415	500
	c) Elongation percent , Minimum	14.5	12
iii)	<b>Bend &amp; Rebend tests</b>	Pass	Pass



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 18 of 26

Annex-3

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

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	-	-	-	95 to 100	100	-	-	
		20 mm	0 to 20	85 to 100	100	-	-	30 to 70	95 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. Flakiness index		Not to exceed 25%									
	c. Crushing Value		Not to exceed 45%									
	d. Presence of deletritious material		Total presence of deleterious materials not to exceed 5%									
	e. Hardness		Abrasion value not more than 40%, Impact value not more than 30%									
	f. Soundness test (for concrete work subject to frost action)		12% when tested with sodium sulphate and 18% when tested with magnesium sulphate									

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 19 of 26

### Annex-4

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

4. Fine aggregates	IS Sieve Designation	Percentage passing for graded aggregate of nominal size		
		F.A. Zone I	F.A. Zone II	F.A. Zone III
i) Physical Tests				
a) Determination of particle size				
	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) Silt content		Not to exceed 8%	Not to exceed 8%	Not to exceed 8%
c) Presence of deleterious material		Total presence of deleterious materials shall not exceed 5%		
d) Soundness Applicable to concrete work subject to frost action		12% when tested with sodium sulphate and 15% when tested with magnesium sulphate		



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 20 of 26  
Annex-5

### ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CONCRETE WORK

1)	Concrete	a) Workability	Slump shall be recorded by slump cone method and it shall be between 25-75 mm. depending upon workability requirement as per IS 456.
		b) Compressive strength	For Design mix as per IS:456 for Grade M20 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 <sup>2</sup> and for 1:2:4(Cement: Fine Aggregate: Coarse aggregate) nominal mix concrete 28 days strength shall be min 210Kg/cm <sup>2</sup> .

#### Notes :

- 1) All Design Mix concrete shall be as per IS: 456.
- 2) ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR DESIGN MIX CONCRETE: AS PER Table-11 of IS:456 as given below:

Specified Grade	Mean of the Group of 4 Non-Overlapping consecutive test results in N/sq mm	Individual Test Results in N/sq mm
M 20 or above	Shall greater than or equal to $f_{ck} + 0.825 \times \text{established standard deviation (rounded off to nearest } 0.5 \text{ N/sq mm)}$ Or $F_{ck} + 3 \text{ N/sq mm, whichever is greater}$	$\geq f_{ck} - 3 \text{ N/sq mm}$

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

### 3) ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR NOMINAL MIX CONCRETE:

- a) On the basis of mandatory lab test result, in case of actual average compressive strength being less than specified strength but up to 70% of specified strength, concrete may be accepted and the rate payable shall be in the same proportion as the actual average compressive strength bears to specified compressive strength..
- b) If the actual average strength of accepted sample is less than 70% of specified strength, the Site-in-charge shall reject the defective portion of work represent 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 / Project In-charge so desires, he may order additional tests to be carried out to ascertain if the structure can be retained/rectified. All the charges in connection with these additional tests shall be borne by the Contractor.
- c) 53 Grade cement shall be used after obtaining specific approval of the Engineer in charge.
- d) Portland slaa cement conforming to IS: 455 may be used as per Technical Specification.

## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 21 of 26

Annex- 6

(Sheet 01 of 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
	No of bricks to be selected	Permissible no of defective in the sample.	
(1)	(2)	(3)	(4)
2001-10000	20	1	40
10001-35000	32	2	60
35001-50000	50	3	80

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

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





## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 22 of 26

Annex- 6

(Sheet 02 of 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)	432 to 468 cm (450 ± 18)
2	WIDTH	176 to 184 cm (180± cm)	213 to 231cm (222± 9)
3	HEIGHT	176 to 184 cm (180± 4 cm)	134 to 146 cm (140 ± 6)

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.



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 23 of 26  
Annexure-7

Page 1 of 2

### 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(Pt.IV) IS:2386 (Pt.IV) IS:5640	60% max. * 50% max
2.	Base	a) Los Angeles Abrasion Value or Aggregate Impact value b) Flakiness Index	IS:2386(Pt.IV) IS:2386 (Pt.IV) IS:5640 IS:2386 (Pt.I)	50% max. * 40% max ** 15% max
3.	Surface Course	a) Los Angeles Abrasion Value or Aggregate Impact value b) Flakiness Index	IS:2386(Pt.IV) IS:2386 (Pt.IV) IS:2386 (Pt.I)	40% max. 30% max 15% max
4	Binding Material	Plasticity index	IS :2720 (Pt 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.



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 24 of 26  
Annexure-7  
Page 2 of 2

### 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



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 25 of 26  
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 Engr means incharge 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 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. Engr.
- 9) The authorized dealer means the dealer whose names are listed in the main producer's web site or certified by the main producers.
- 10) Accepting Authority for testing Laboratory shall be Regional Head.



## STANDARDISED FIELD QUALITY PLAN

Item	Switchyard Civil works
Applicability	POWERGRID Projects
Date of Issue	29.01.2016
Validity	Till next revision

SFQP No.	DOC No.C/QA&I/SFQP/SCW
REV.	04

Page 26 of 26

- 11) Mobile testing Labs owned by the contractor may also be acceptable if their facilities meet the testing requirements and the testing equipments are properly calibrated at Third Party Labs where testing/calibration is to be carried out should be accredited by NABL or an agency operating in line with ISO/IEC 17011 and having full membership & MRA of ILAC/APLAC, subject to approval of project Incharge.
- 12) **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 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 cu.m or part thereof for each day of concreting and 28 days compressive strength shall be tested in line with IS:456.**
- 13) Epoxy coating on reinforcement steel wherever required shall be done as per IS 13620.
- 14) Cement is to be used in the order it is delivered (ie. First in First Out). Cement bought to works shall not be more than 6 weeks old from the date of manufacture.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.
- 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.

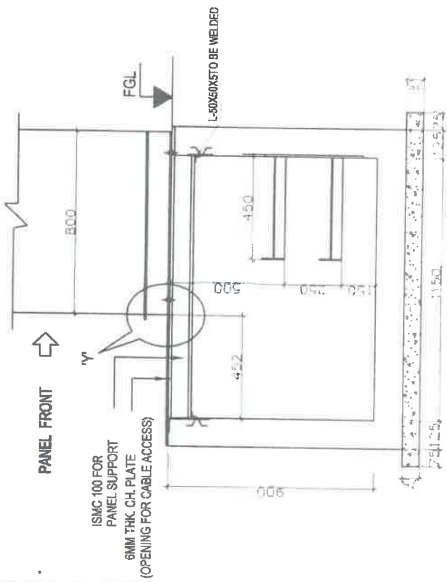




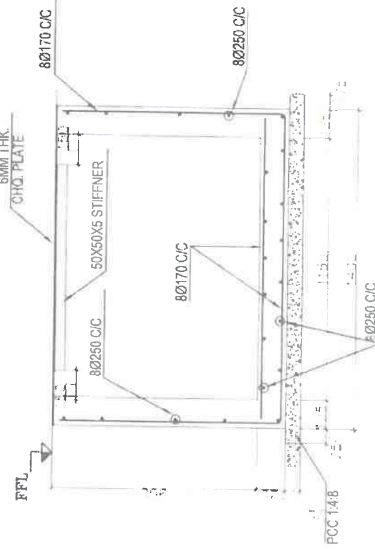




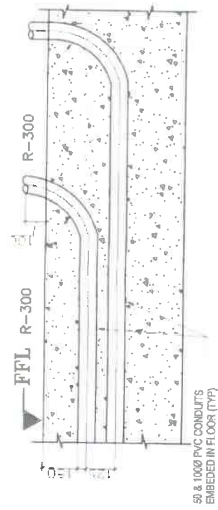




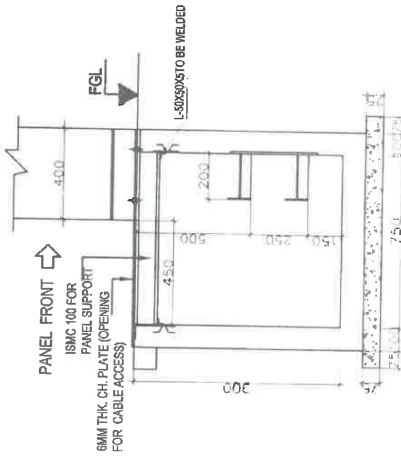
SECTION 1-1  
(SHOWING GENERAL ARRANGEMENT DETAILS)



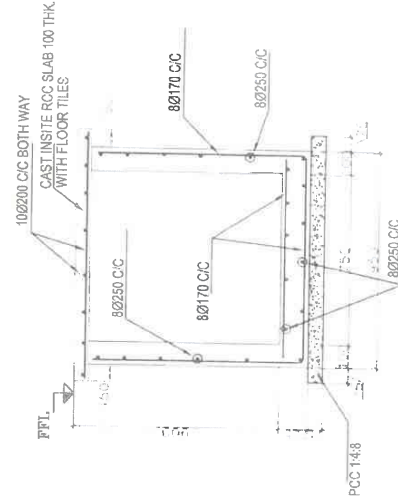
SECTION 1-1  
(SHOWING REINFORCEMENT DETAILS)



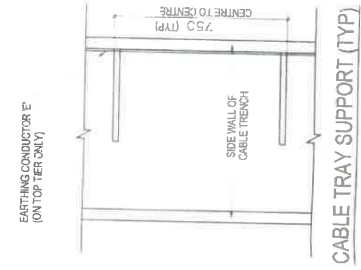
TYP. SECTION



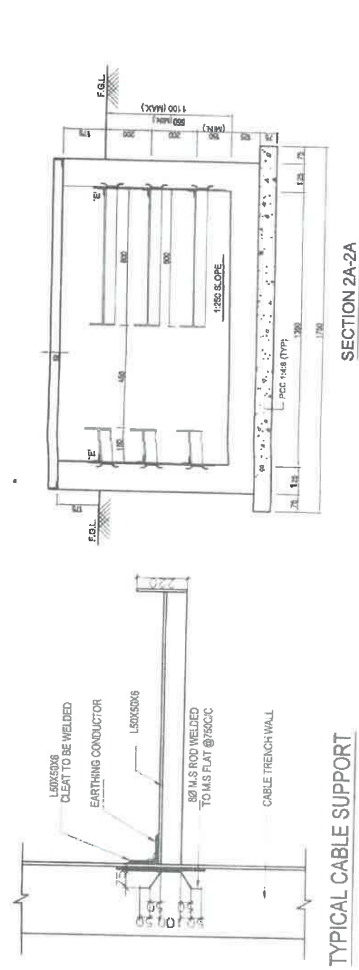
SECTION 2-2  
(SHOWING GENERAL ARRANGEMENT DETAILS)



SECTION 2-2  
(SHOWING REINFORCEMENT DETAILS)



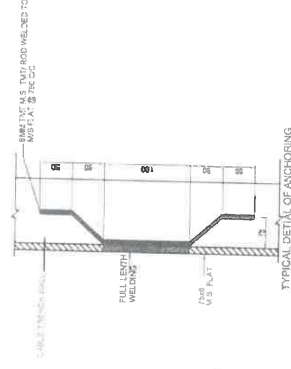
CABLE TRAY SUPPORT (TYP)



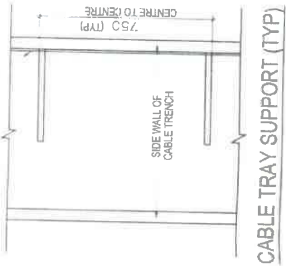
## TYPICAL CABLE SUPPORT



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



TYPICAL DETAIL OF ANCHORAGE



CABLE TRAY SUPPORT (TYP)

NOTES :-

1. ALL DRAWINGS ON A4 IN MM UNLESS NOTED OTHERWISE
2. FOR TITLES, LOGO, LOGO-SIZE, LOGO-TEXT: 100 MM
3. FOR STRUCTURE: 100 MM
4. FOR STRUCTURE: 100 MM
5. TOP OF CHAIR/PLATE TO FINISH WITH FINISHED 50mm LEVEL
6. THIS DRAWING SHALL BE MATCHED WITH VENDOR'S APPROVED INTERNAL CABLE TRENCH/LOUT DRAWING BEFORE START OF CONSTRUCTION
7. ALL WELLS ARE 50MM FILL CONTINUOUS WELD UNLESS SPECIFICALLY NOTED OTHERWISE
8. PLATE WHEREVER CABLE TRENCH/LOUT IS 100 MM
9. FOR CABLE TRENCH/LOUT WITH LESSER THAN 100MM STEEPNESS SHALL BE WELDED WITH CHAIR/PLATE @ 100 MM

RELEASED FOR TENDER/CONSTRUCTION

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

NOTE:

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)

page 75 of 87

0.	REVISED AS MARKED
----	-------------------

---

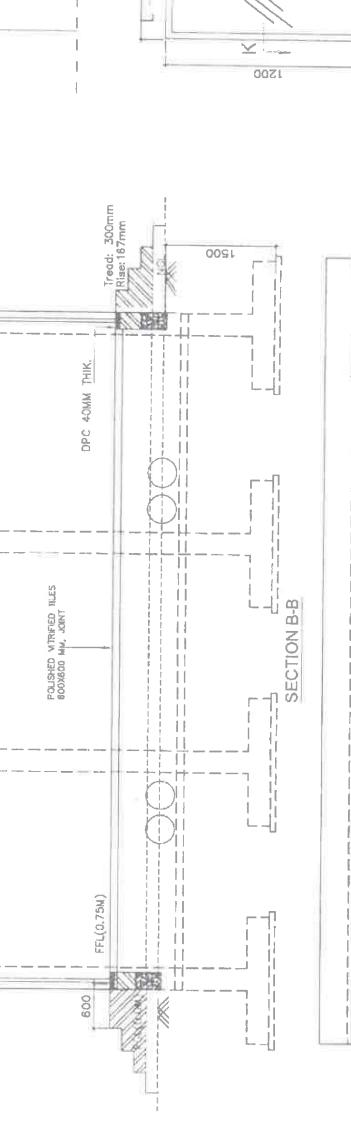
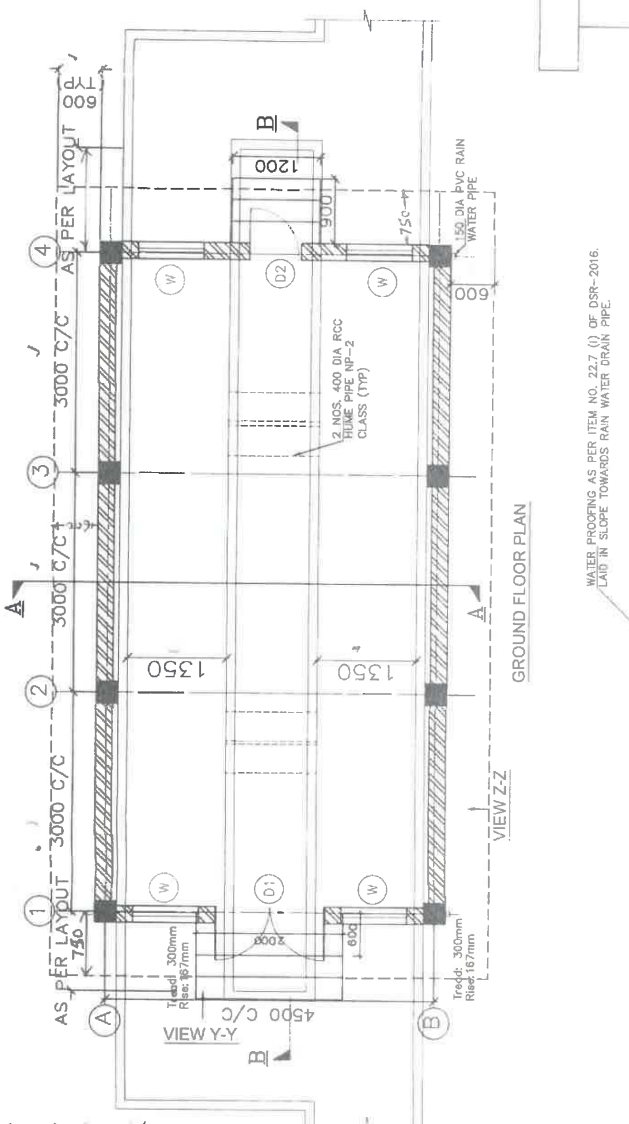
---

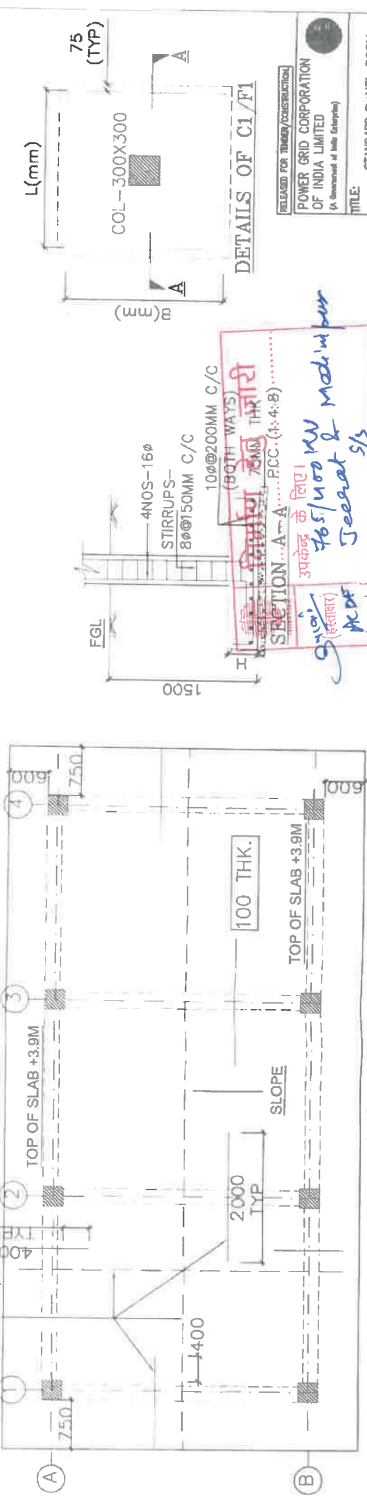
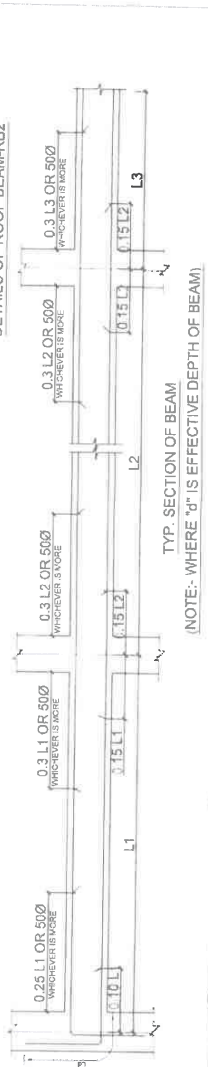
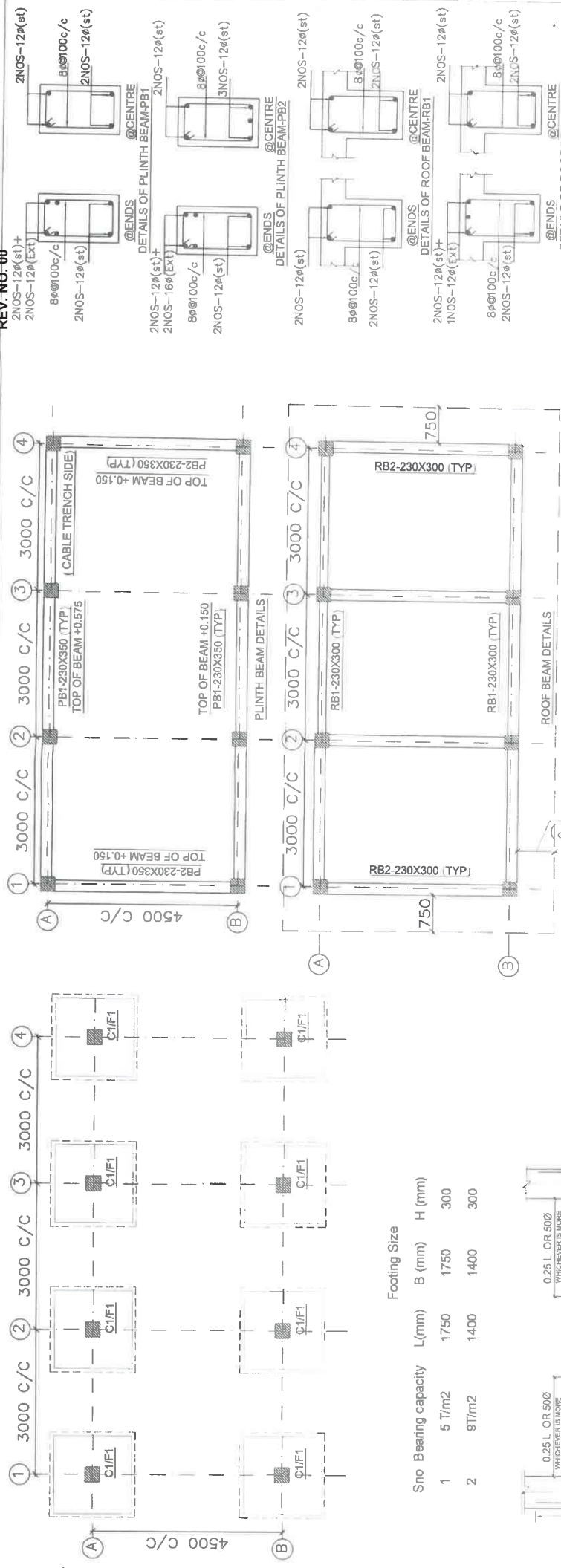
[illegible]

REF	DESCRIPTION
-----	-------------

0.4294

[illegible]

[illegible][illegible]



- GENERAL NOTES:**
- ALL DIMENSIONS ARE IN MM AND LEVELS IN METERS.
  - THIS DRAWING IS NOT TO BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
  - 0.00 CORRESPONDS TO FINISHED GROUND LEVEL (F.G.L.)
  - ALL R.C.C. USED SHALL BE OF GRADE AS PER SPECIFICATION.
  - ALL R/F STEEL SHALL BE HYSD (Fe 500) CONFORMING TO IS:1786/TMT BARS (EQUIVALENT GRADE)
  - CLEAR COVER FOR MAIN R/F BARS SHALL BE 40MM FOR COLUMN, 25MM FOR BEAMS, 15MM FOR SLAB, 50MM FOR FOOTINGS
  - LAP LENGTH FOR R/F BARS SHALL BE 50 X DIA OF BAR.
  - LAP SHALL NOT BE PROVIDED WITHIN A JOINT, OR WITHIN A DISTANCE 2 X DEPTH FROM THE EACH JOINT FACE, OR 1/4 OF MEMBER LENGTH FROM JOINT FACE
  - LOOSE 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)
  - NET SAFE BEARING CAPACITY AT 1.5M BELOW FGL SHALL BE VERIFIED BEFORE EXECUTION AND THE SIZE OF THE FOOTING SHALL BE ADAPTED BASED ON THE SEC. IN-CASE OF ANY DISCREPANCY PLEASE CONTACT ENGS.
  - 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 ARCHITECTURAL DRAWING

RELIEF FOR TENDER CONSTRUCTION

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

TITLE: STANDARD PANEL ROOM

SUB TITLE: F.C.U.N. DATA/01/13  
STANDARD SWITCHYARD  
STANDARD ROOM RCC DETAIL  
OF PANEL ROOM (7/12)

DRAWING NO: C/ENR/570/RR/2017

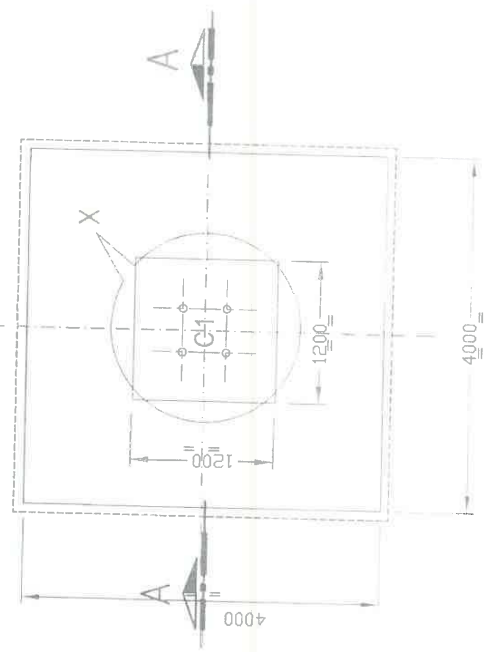
DATE: 16/11/18

Page 77 of 87

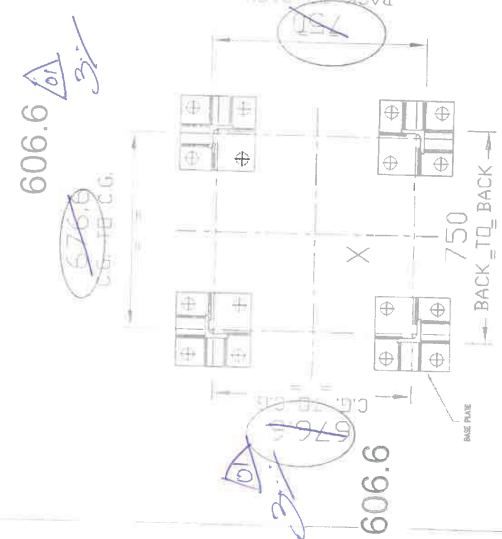




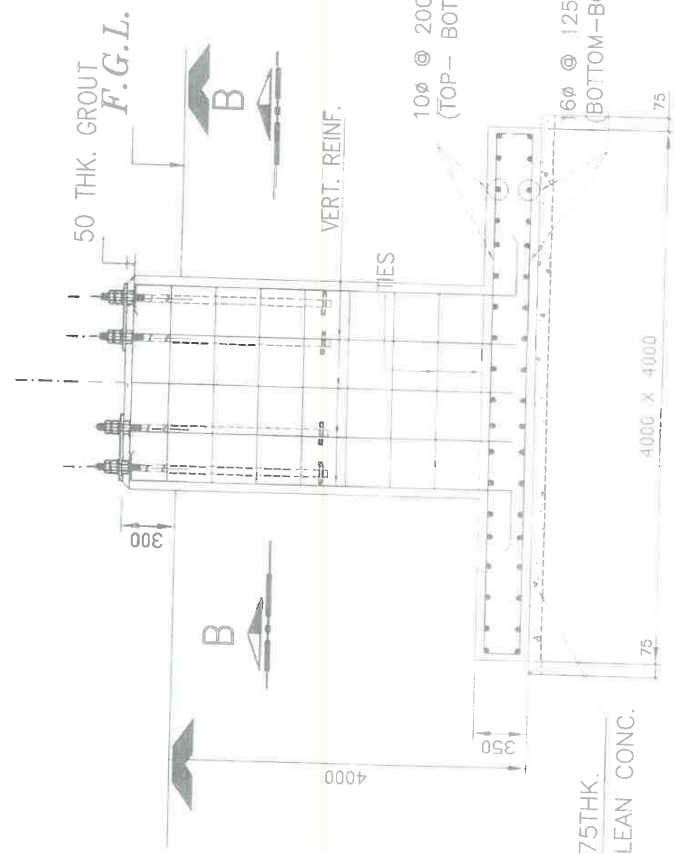
LOC. OF EQP. COL./FOUND.



FOUNDATION PLAN FOR EQUIPMENT  
MKD. 765 kV ISO



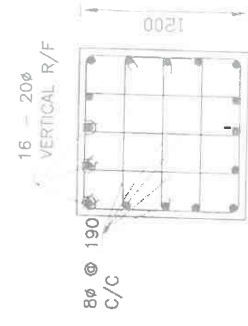
TYP. ANCHOR BOLT SETTING PLAN FOR 765  
KV ISO



SECTION A-A



DETAIL AT - 'X'  
ANCHOR BOLT SETTING PLAN



SECTION B-B

IMP. - LOCATION OF FDN. BOLTS SHALL  
BE VERIFIED FROM APPROVED SUPP.  
STR. DRAWING BEFORE EMBEDDEDMENT

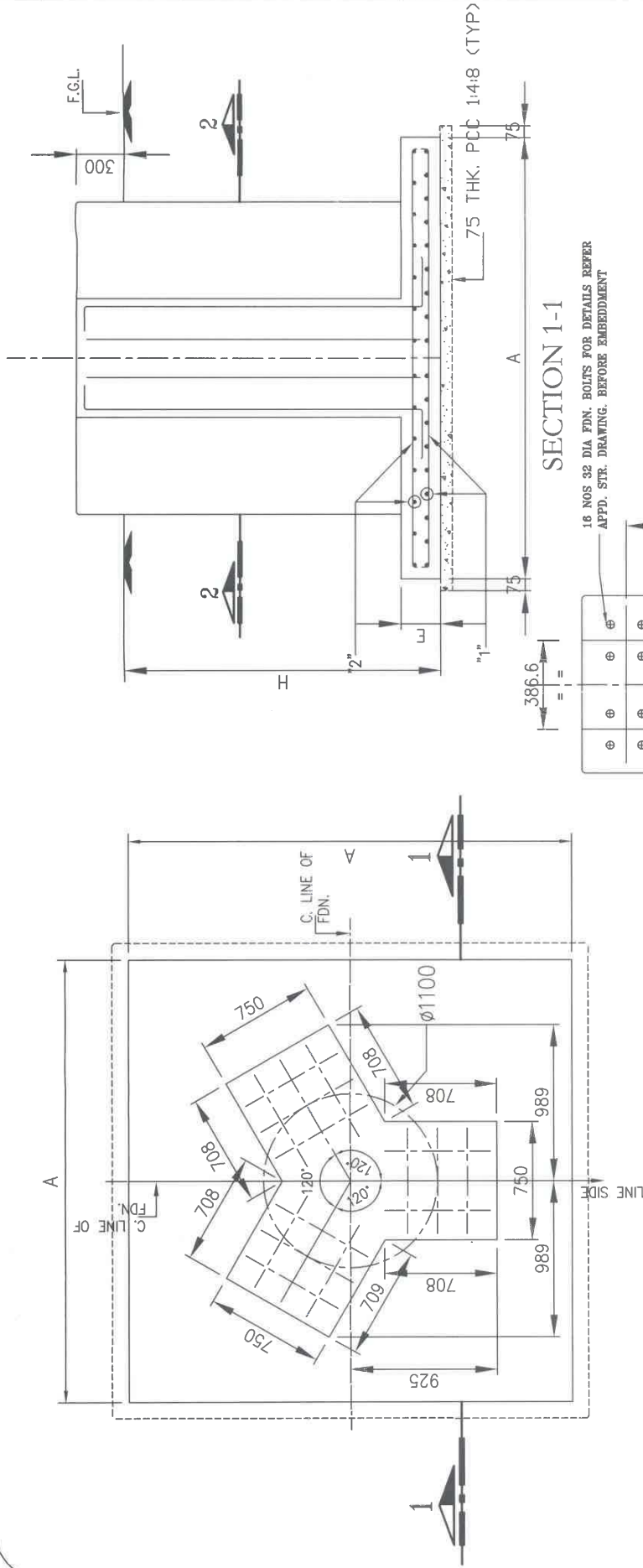
RELEASED FOR CONSTRUCTION

General Notes	
1.	FOR DETAILS OF FDN. BOLTS REFER APPROVED STRUCTURE DRAWING.
2.	IN THIS DRAWING, DENOTES REINF. STEEL CONFORMING TO IS:1786 - 1985 OF GRADE Fe 500
3.	LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
4.	PROVIDE CLEAR COVER TO REINF. AS UNDER: * 50mm FOR BOTTOM, TOP & SIDE REINFORCEMENT OF RAFT. * 50mm FOR COLUMN.
5.	ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE NOTED
6.	DO NOT SCALE THE DRAWING. ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
7.	UNLESS OTHERWISE NOTED ALL CONCRETE SHALL BE OF GRADE M-25
8.	FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN. LAYOUT

PLEASE NOTE:  
MAXIMUM DEPTH  
OF FILLING  
CONSIDERED FOR  
DESIGN IS 2.0 M

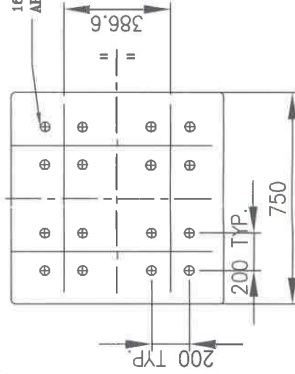
1.	RO	25.1.18
No.	Revision/Issue	Date
POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise)		
PROJECT: 765/400 kV JERAT S/S UNDER TBCB		
TITLE: FOUNDATION DETAILS OF 765KV ISOLATOR STRUCTURE MKD 7150		
DRAWING NO: C/ENG/ERI/JRT/765/EOP/FDN/02		
SCALE	N.T.S.	Sheet 1 OF 2





FOUNDATION PLAN

16 NOS 32 DIA FDN. BOLTS FOR DETAILS REFER  
APPD. STR. DRAWING, BEFORE EMBEDMENT



ANCHOR BOLTS FIXING DETAILS

S/S NAME	A	H	E	V	1	2
MEDINIPUR	2800	2000	250	160 @ 200C/C	120 @ 150C/C	100 @ 200C/C
JEERAT	3500	3200	350	160 @ 150 C/C	160 @ 150C/C	100 @ 150C/C

8Ø RINGS @ 250 C/C

V ON PERIPHERY

SECTION 2-2

General Notes

1. IN THIS DRAWING, DENOTES TOR STEEL CONFORMING TO IS:1786 OF GRADE Fe 500
2. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
3. PROVIDE CLEAR COVER TO REINF. 50mm FOR BOTTOM, TOP & SIDE REINFORCEMENT OF RAFT.
4. ALL DIMENSIONS ARE IN MM & LEVEL IN M, UNLESS OTHERWISE NOTED
5. DO NOT SCALE THE DRAWING. ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
6. UNLESS OTHERWISE NOTED ALL CONCRETE SHALL BE OF GRADE M25
7. FINAL EXCAVATION LEVEL SHALL BE MIN. 500mm BELOW NGL
8. REF. DRAWING No: Y76550 (765 KV)
9. SITE SHALL VERIFY ANCHOR BOLT FIXING DETAILS FROM APPROVED SUPPORT STRUCTURE FABRICATION DRAWING BEFORE CASTING

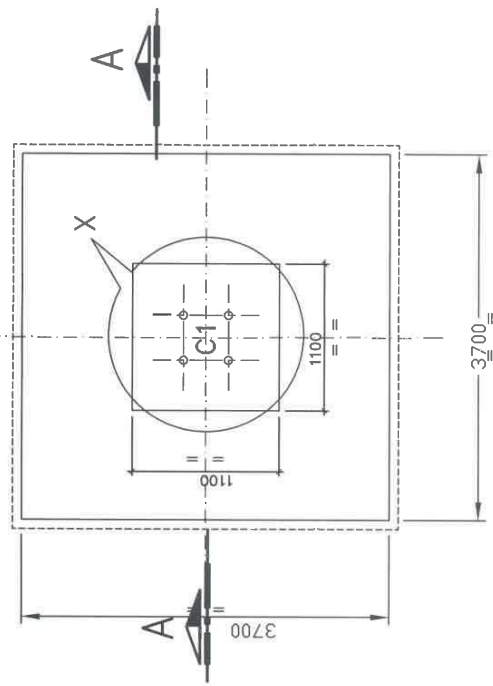
POWERGRID CORPORATION  
OF INDIA LIMITED  
(A Government of India Enterprise)

PROJECT: 765/400 KV SUB-STATION  
AT MEDINIPUR & JEERAT

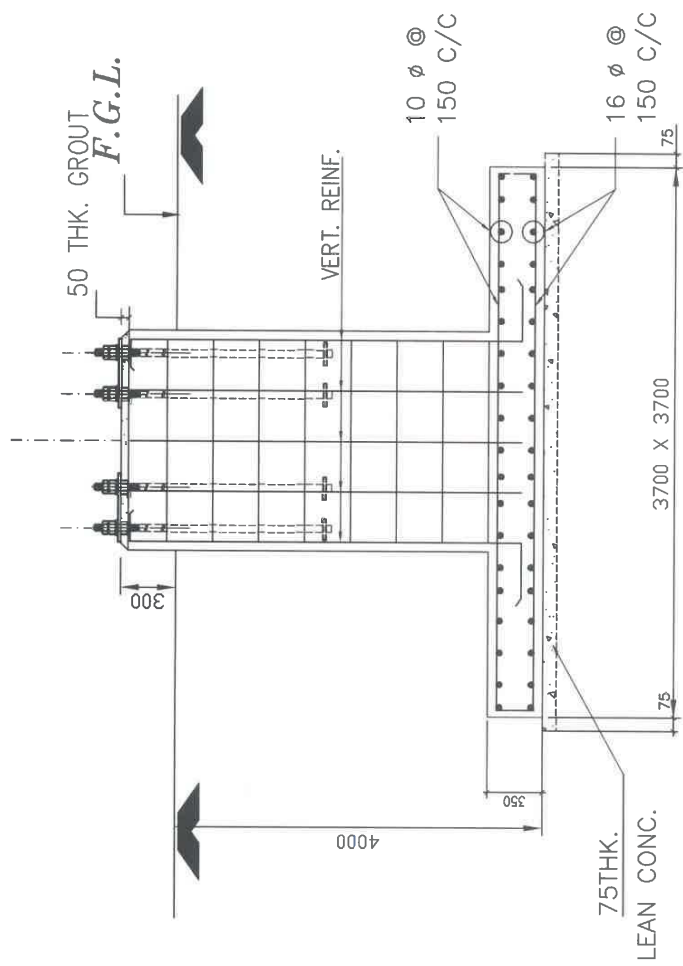
TITLE: FOUNDATION DETAILS OF  
765KV 'WT' BEG MAKE  
3150MVA/110mm  
DRAWING NO:  
C/ENG/MEDINIPUR/RT/765/WT/FDN/01

SCALE: 1:1.5  
SCALE: 1:1.5  
REV: 00

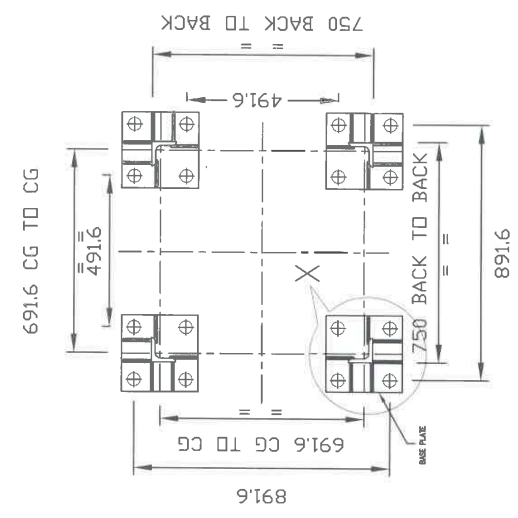
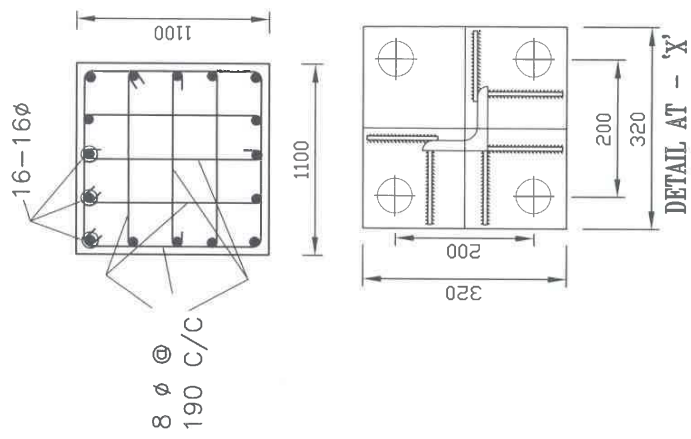
PLAN OF EQP. COL./FOUND.



FOUNDATION PLAN FOR 765 KV CT STRUCTURE



SECTION A-A



TYP. ANCHOR BOLT SETTING PLAN FOR  
EQP. EXCEPT CT

IMP: - LOCATION OF FDN. BOLTS SHALL  
BE VERIFIED FROM APPROVED SUPP.  
STR. DRAWING BEFORE EMBEDDEDMENT

RELEASED FOR CONSTRUCTION

General Notes

1. FOR DETAILS OF FDN. BOLTS REFER APPROVED STRUCTURE DRAWING.
2. IN THIS DRAWING Ø DENOTES REINF. STEEL CONFORMING TO IS:1786 - 1985 OF GRADE Fe 500
3. LAP LENGTH SHALL BE 47 TIMES DIA OF BAR.
4. PROVIDE CLEAR COVER TO REINF. AS UNDER.  
\* 50mm FOR BOTTOM, TOP & SIDE REINFORCEMENT OF RAFT.  
\* 50mm FOR COLUMN.
5. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE NOTED
6. DO NOT SCALE THE DRAWING. ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
7. UNLESS OTHERWISE NOTED ALL CONCRETE SHALL BE OF GRADE M-25
8. FOR ORIENTATION OF FOUNDATION REFER APPROVED FDN. LAYOUT

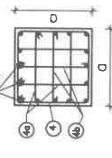
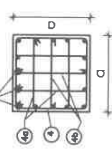
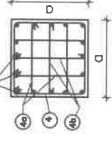
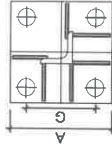
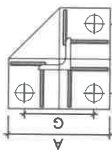
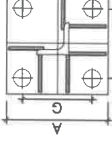
PLEASE NOTE:  
MAXIMUM DEPTH  
OF FILLING  
CONSIDERED FOR  
DESIGN IS 2.0 M

2.	R1	31.08.18
1.	R0	09.08.18
No. Revision/Issue Date		
POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise)		

PROJECT: 765/400 KV JEERAT S/S UNDER TBCB		
TITLE: FOUNDATION DETAILS OF 765KV EQUIPMENTS MKD. CT		
DRAWING NO: C/ENG06/ERI/JRT/765/CT/FDN/01		
SCALE	N.T.S.	Sheet 01



FOUNDATION & COLUMN SCHEDULE FOR 765KV EQUIPMENT MARKED :-

EQUIPMENT MARKED		LA	CVT	BPI
RAFT SIZE A x B		4000 X 4000	3000 X 3000	3700 X 3700
RCC COLUMN SIZE a x b		1000 X 1000	1000 X 1000	1050 X 1050
BASE WIDTH	C/G. TO C/G. (X x Y)	543.2 X 543.2	542 X 542	691.6 X 691.6
	BACK TO BACK (L x W)	800 X 600	800 X 600	750 X 750
BASE PLATE DETAILS	LENGTH 'A'	300	320	300
	WIDTH 'B'	300	320	300
ANCHOR BOLTS SPACING C/C DISTANCE H x G		200 X 200	200 X 200	200 X 200
NO OF ANCHOR BOLTS		4	3	4
FOUNDATION BOLT-DIA.		28	32 / 01	32
RAFT THICKNESS 'E'		300	300	300
FOUNDATION BOLT - INNER BOLT C/C x X d		343.2 X 343.2	342 X 342	491.6 X 491.6
FOUNDATION BOLT - OUTER BOLT C/C U x V		743.2 X 743.2	742 X 742	891.6 X 891.6
REINFORCEMENT IN RAFT SLAB				
REINFORCEMENT @ BOTTOM BOTHWAYS - ①		12ϕ 120 C/C	12ϕ 200 C/C	12ϕ 120 C/C
REINFORCEMENT @ TOP BOTHWAYS - ②		10ϕ 200 C/C	10ϕ 200 C/C	10ϕ 200 C/C
COLUMN REINFORCEMENT				
VERTICAL REINF. - ③		16-16ϕ	16-16ϕ	16-16ϕ
TIES - ④		8ϕ 190 C/C	8ϕ 190 C/C	8ϕ 190 C/C
		8ϕ 190 C/C	8ϕ 190 C/C	8ϕ 190 C/C
		8ϕ 190 C/C	8ϕ 190 C/C	8ϕ 190 C/C
SECTION 2				
ANCHOR BOLT SETTING PLAN				

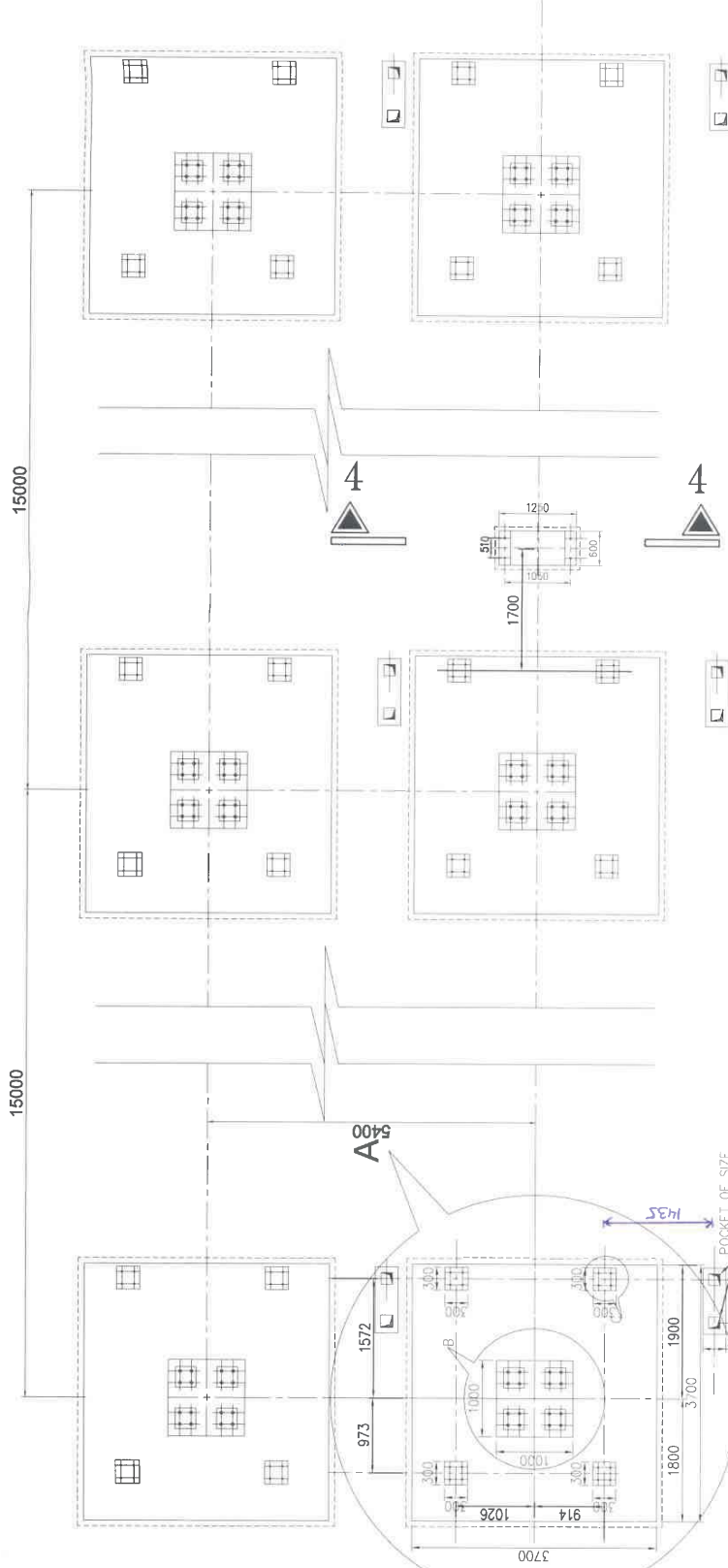
RELEASED FOR CONSTRUCTION

Rev 01 mkd. as per 01		Rev 01	Rev 01	Rev 01	Rev 01
DESCRIPTION	PREP.	REV.	REV.	APPD.	DATE

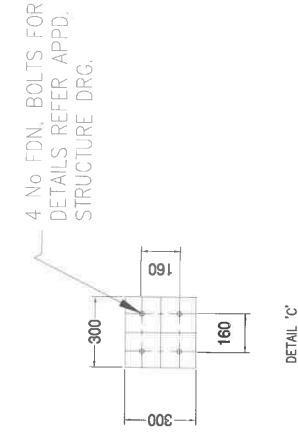
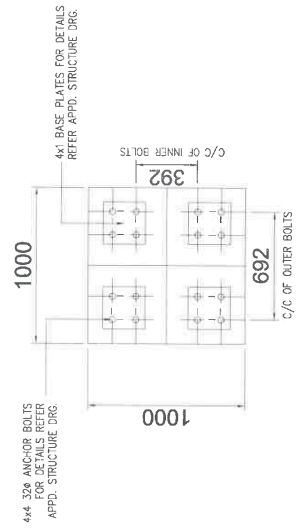
2.	R1	31/08/2018
1.	R0	09/08/2018
No.	Revision/Issue	Date


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

PROJECT:	765/400 kV MEDINIPUR S/S UNDER TBCB
TITLE:	FOUNDATION DETAILS OF 765KV EQUIPMENTS MKD. LA, CVT, BPI
DRAWING NO:	C/ENG/ERII/JRT/765/EQP/FDN/01
SCALE	SCALE N.T.S.
Sheet	2 OF 2



## KEY PLAN

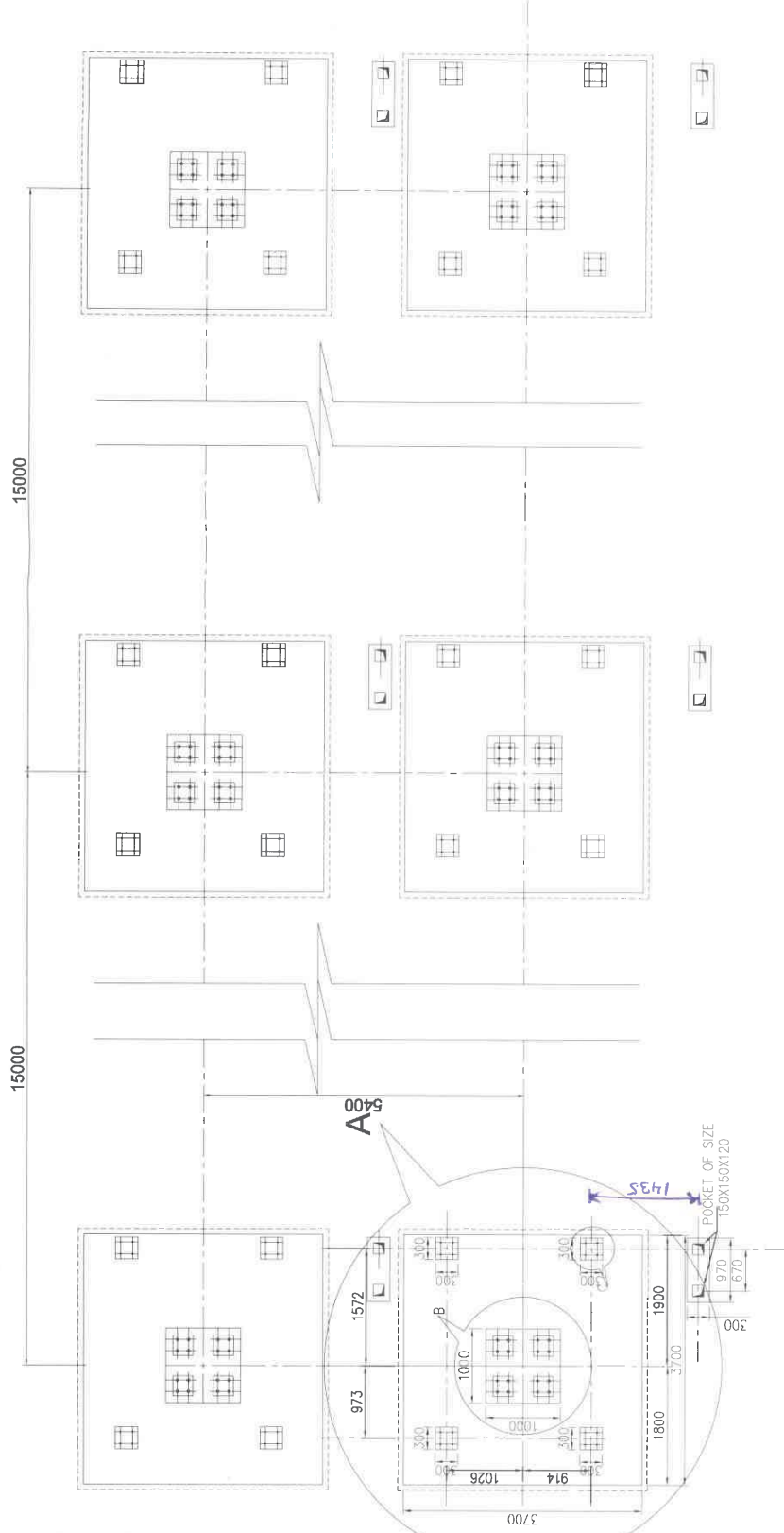


1.	R0	20.11.18
No.	Revision/Issue	Date
		
POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise)		
PROJECT: 765/400KV SUB-STATION		
AT JEERAT		
TITLE: FOUNDATION DETAILS		
FOR 765KV CIRCUIT BREAKER – SIEMENS		
MAKE – 3PH TO 1PH CHANGE OVER (WITH MARSHALLING BOX)		
DRAWING NO: _____		
C/ENGSG/ART/765/400/SIEMENS/FW/02		
SCALE	N.T.S.	Sheet 1 OF 2 R1

RELEASED FOR CONSTRUCTION	PREP.	REV'D. ELEC.	REV'D. ELEC.	APPD.	DATE
	10/1/00		10/1/00		10/1/00





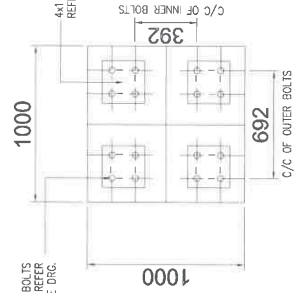


## KEY PLAN

4x4 320 ANCHOR BOLTS FOR DETAILS REFER APPD. STRUCTURE DRG.

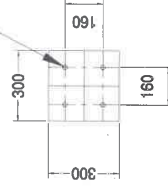
1000

4x1 BASE PLATES FOR DETAILS REFER APPD. STRUCTURE DRG.



### DETAIL 'B'


4 No FDN. BOLTS FOR  
DETAILS REFER APPD.  
STRUCTURE DRG.

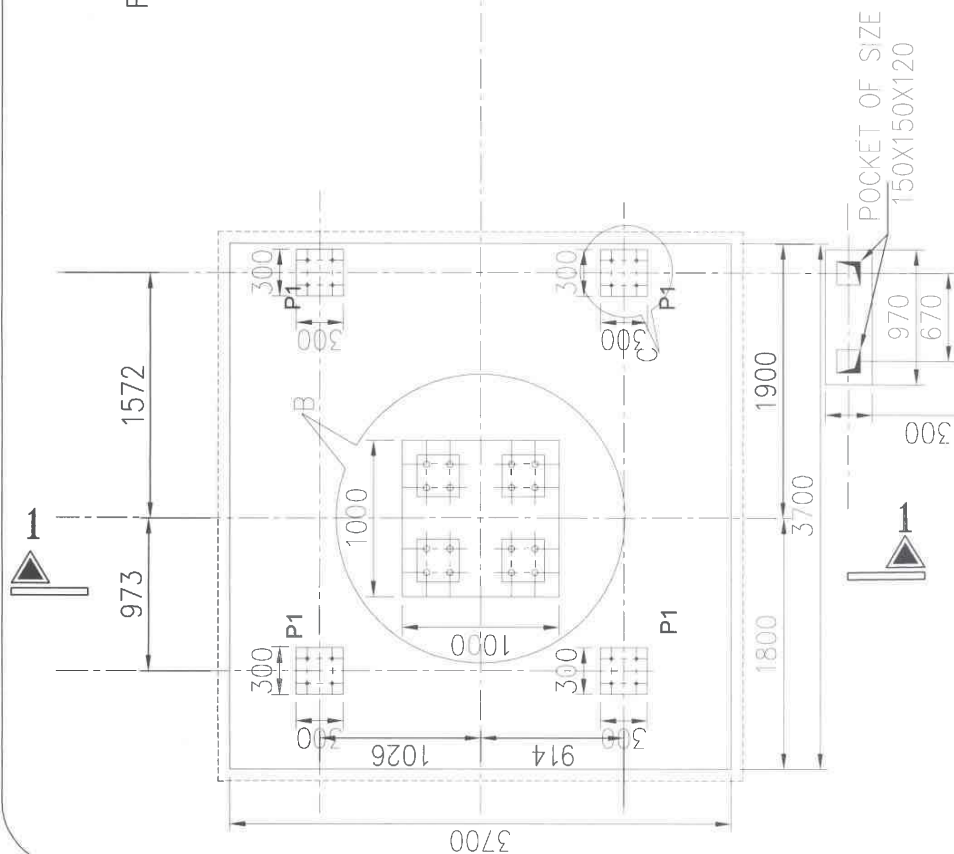


DETAIL 'C'

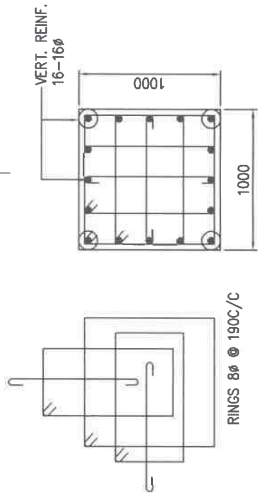
RELEASED FOR CONSTRUCTION

RELEASED FOR CONSTRUCTION	PREP.	REVD. ELEC.	REVD.	APPD.	DATE
	10/11/05	10/11/05	10/11/05	10/11/05	10/11/05

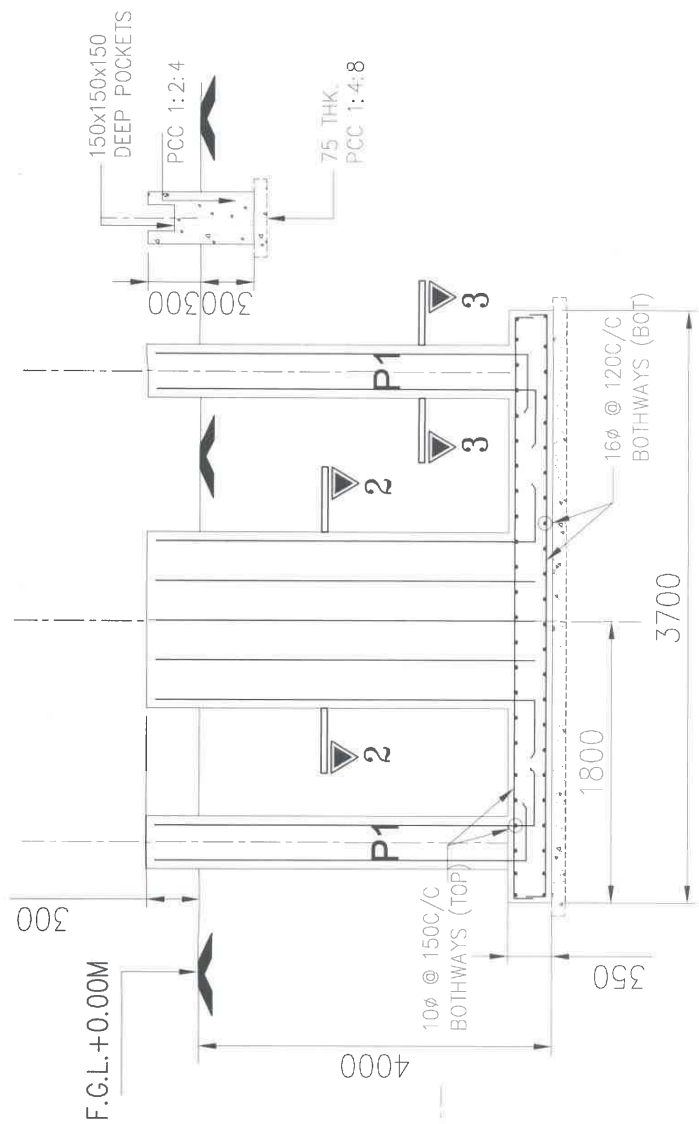
1.	R0	Date	20/11/18
No.	Revision/Issue		
POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise)			
			
PROJECT: 765/400KV SUB-STATION AT JEERAT			
TITLE: FOUNDATION DETAILS FOR 765KV CIRCUIT BREAKER – SIEMENS MAKE – 3PH TO 1PH CHANGE OVER (WITH MARSHALLING BOX)			
DRAWING NO: C/ENG/CART/765/CB/SIEMENS/FDN/01			
SCALE	N.T.S.	Sheet 1 OF 2	RI



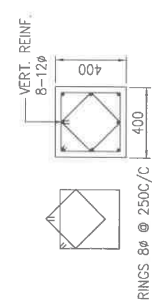
DETAIL 'A'



SECTION 2-2



SECTION 1-1



SECTION 3-3 (P1)

FOR GENERAL NOTES REFER SH. 1 OF 2

RELEASED FOR CONSTRUCTION	PREP.	REVD. ELEC.	REVD.	APPD.	DATE

1.	RO	30.11.18
No.	Revision/Issue	Date
POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise)		
PROJECT: 765/400KV SUB-STATION AT JEERAT		
TITLE: FOUNDATION DETAILS FOR 765KV CIRCUIT BREAKER - SIEMENS MAKE - 3PH TO 1PH CHANGE OVER (W/O MARSHALING BOX)		
DRAWING NO: C/ENG65/JRT/765/09/SIEMENS/PDW/03		
SCALE	N.T.S.	Sheet 2 OF 2
		R0