

1 x 51MW CCCPP Power Project for ONGC Hazira

Sl.No	Recommendations of Soil properties in Cooling Tower Area					
1	Average NGL	EL+99.700M/ RL 6.0M				
2	Finished Ground Level (FGL)	EL+101.200M/ RL 7.5M				
3	Finished Floor Level (FFL)	EL+101.700M				
4	Top of Paving	EL+101.400M				
5	Design Ground Water Table	EL +99.700M				
6	Cement Type	Portland slag cement with minimum 50 % slag or Portland pozzolana cement				
7	Soil Parameters to be considered for Cooling Tower Area	Layer Thickness from NGL m	Cohesion T / m ²	Angle of Internal Friction	Field Density T / m ³	SPT N Value
		5.9	3.3	3	1.8	4
		7.0	0	32	2.0	24
		4.5	0	36	2.2	80
		3.5	18.7	0	2.14	80
		9.1	0	36	2.2	80
8	Net Safe bearing capacity for Shallow Footing(T/m²) Note: The minimum depth of foundation shall be 2.5 m from FGL.	Size of footing(LXB) (mXm)	2.5 m Depth from FGL (EL 101.20)			
		2.0x1.0	9			
		2.0x2.0	8			
		3.0x1.5	8			
		3.0x3.0	6			
9	S.B.C to be considered for lightly loaded foundations at 1.0m below FGL shall be 9T/m ²					
10	Pile Description(Bored Cast in situ Pile)					
	(i) Dia	500mm				
	(ii) Pile cut off Level	EL 98.9M				
	(iii) Pile Capacity	Vertical(T)	Uplift(T)	Horizontal (Fixed Head)(T)	Horizontal (Free Head)(T)	
		65	20	5	2	
11	Others include:					

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| | <ul style="list-style-type: none">a) In case if shallow spread footings are opted for, the minimum depth of foundation shall be 2.5 m from FGL of 101.2m to avoid the consequences of swelling and shrinking due to moisture movement.b) Due to expansive nature of soil, a compacted clean, coarse sand cushion layer of 30 cm shall be provided under pilecaps/footings and aprons around the structures and plinths under floor finishes. Any structural component shall not be in contact with clays of high plasticity.c) Based on results of chemical tests, the buried concrete shall be designed for severe exposure condition as suggested in Table no. 3 of IS: 456, 2000. The minimum cement content though shall not be less than 320 kg/m³ and the W/C shall not be more than 0.45d) Drainage Properties of the soil are poor.e) Fill material for use in the foundations, trenches or in the building plinths and in the subgrade of pavements shall not be expansive soil. The fill materials should be free of organics, debris, or other deleterious materials. Any imported materials shall have water-soluble sulphate and chloride contents that are less than 1000 parts per million and 500 parts per million, respectively, pH greater than 7.0 and Expansion Index less than 20. Fill material for use in the foundations, trenches or in the building plinths and in the subgrade of pavements shall consists of cohesive non swelling granular material. |
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Project : Proposed structures in 1X51 MW CCCP Plant of ONGC at Hazira for BHEL

Bore Hole No. : 1

Location : Cooling tower area

Date of Start: 25/8/15

Co ordinates of Bore Hole : N 808.2, E 1845.87 m

RL of Ground : 100.215m

Date of Completion: 26/8/15

Machine and bit Used : Calyx machine fitted with cross blade clay cutter and saw tooth bits

Diameter of Bore : 150mm

Depth of Water Table : Observed at 1.90m depth on 72 hrs of drilling completion

Depth of Termination : 30 m

BORE LOG DATA SHEET

Method of Boring	Depth m	RL m	Casing	Notation	Soil Description	Depth of Sample m	Drill Run		Type of Sample	SPT N value / Penetration				FBD/FDD gm/cc	NMC %	Remarks	
							From	To		N ₁	N ₂	N ₃	N				
							m	m		m	m	m	m	m	m		m
Rotary Drilling by mud circulation	0.0	100.215	Not Used	III			0.00	0.00	1.00	DS	-	-	-	-	-	-	
	0.5	99.715					1.00	1.00	2.00	DS	-	-	-	-	-	-	
	1.0	99.215					2.00	2.00	3.00	SPT	4	5	6	11	-	-	
	1.5	98.715					3.00	3.00	4.00	UDS	-	-	-	-	1.80 /	29.86	
	2.0	98.215					4.00	4.00	5.00	SPT	1	2	2	4	-	-	
	2.5	97.715					5.00	5.00	6.00	UDS	-	-	-	-	1.77 /	32.64	
	3.0	97.215					6.00	6.00	7.00	SPT	5	8	9	17	-	-	
	3.5	96.715					7.00	7.00	8.00	UDS	-	-	-	-	1.83 /	21.43	
	4.0	96.215					8.00	8.00	9.00	DS	-	-	-	-	1.51	-	
	4.5	95.715					9.00	9.00	10.00	SPT	4	9	15	24	-	-	
	5.0	95.215					10.00	10.00	11.00	DS	-	-	-	-	-	-	
	5.5	94.715					11.00	11.00	12.00	SPT	6	14	32	46	-	-	
	6.0	94.215					12.00	12.00	13.00	DS	-	-	-	-	-	-	
	6.5	93.715					13.00	13.00	14.00	SPT	22	57	-	>100	-	-	
	7.0	93.215					14.00	14.00	15.00	DS	-	-	-	-	-	-	
	7.5	92.715					15.00	15.00	16.50	SPT	27	40	-	>100	-	-	
	8.0	92.215					16.00	16.00	17.00	DS	-	-	-	-	-	-	
	8.5	91.715					17.00	17.00	18.00	DS	-	-	-	-	-	-	
	9.0	91.215					18.00	18.00	19.00	UDS	-	-	-	-	2.14 /	18.43	
	9.5	90.715					19.00	19.00	20.00	SPT	22	23	50	>100	-	-	
	10.0	90.215					20.00	20.00	21.00	DS	-	-	-	-	-	-	
	10.5	89.715					21.00	21.00	22.00	SPT	56	-	-	>100	-	-	
	11.0	89.215					22.00	22.00	23.00	DS	-	-	-	-	-	-	
	11.5	88.715					23.00	23.00	24.00	SPT	49	-	-	>100	-	-	
	12.0	88.215					24.00	24.00	25.50	DS	-	-	-	-	-	-	
	12.5	87.715					25.00	25.00	26.00	DS	-	-	-	-	-	-	
	13.0	87.215					26.00	26.00	27.00	SPT	57	-	-	>100	-	-	
	13.5	86.715					27.00	27.00	28.00	DS	-	-	-	-	-	-	
	14.0	86.215					28.00	28.00	29.00	DS	-	-	-	-	-	-	
	14.5	85.715					29.00	29.00	30.00	DS	-	-	-	-	-	-	
15.0	85.215	30.00	30.00	30.40	DS	-	-	-	-	-	-						

Drilling terminated at planned depth.

K.C.T. Consultancy Services®

Project : Proposed structures in 1X51 MW CCCP Plant of ONGC at Hazira for BHEL

Bore Hole No. : 11

Location : Cooling tower area

Date of Start: 24/8/15

Co ordinates of Bore Hole : N 805, E 1802 m

RL of Ground : 99.876m

Date of Completion: 25/8/15

Machine and bit Used : Calyx machine fitted with cross blade clay cutter and saw tooth bits

Diameter of Bore : 150mm

Depth of Water Table : Observed at 2.10m depth on 72 hrs of drilling completion

Depth of Termination : 30 m

BORE LOG DATA SHEET

Method of Boring	Depth m	RL m	Casing	Notation	Soil Description	Depth of Sample m	Drill Run		Type of Sample	SPT N value / Penetration				FBD/FDD gm/cc	NMC %	Remarks
							From	To		N ₁	N ₂	N ₃	N			
							m	m								
Rotary Drilling with mud circulation	0.0	99.876	Not Used	---	Dark brownish, fine to very fine grained, sandy clays of low plasticity (CL) 0.00 to 1.00m	0.00	0.00	1.50	DS	-	-	-	-	1.71 / 1.33	28.41	
	0.5	99.376				1.00	1.50	3.00	SPT	4	5	6	11			
	1.0	98.876			Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI) 1.00 to 2.00m	1.50	1.50	3.00	SPT	4	5	6	11			
	1.5	98.376				Dark brownish, fine to very fine grained, silty clays of high plasticity (CH) 2.00 to 3.50m	2.00	2.00	3.50	UDS	-	-	-			
	2.0	97.876			Dark brownish, fine to very fine grained, silty clays of high plasticity (CH) 2.00 to 3.50m		2.50	2.50	3.50	SPT	3	3	5			
	2.5	97.376				Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI)	3.00	3.00	4.50	UDS	-	-	-			
	3.0	96.876			Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI)		3.50	3.50	4.50	SPT	3	3	5			
	3.5	96.376				3.50 to 5.90m	4.00	4.00	6.00	SPT	1	1	-			
	4.0	95.876			Dark greenish grey, fine to very fine grained, silt of high plasticity (MH) 5.90 to 7.40m		4.50	4.50	6.00	SPT	1	1	-			
	4.5	95.376				Dark greenish grey, fine to very fine grained, silt of high plasticity (MH) 5.90 to 7.40m	5.00	5.00	7.50	UDS	-	-	-			
	5.0	94.876			Dark greenish grey, fine to very fine grained, silt of high plasticity (MH) 5.90 to 7.40m		5.50	5.50	7.50	UDS	-	-	-			
	5.5	94.376				Dark blackish brown, fine to very fine grained, silty clays of high plasticity (CH) 7.40 to 8.50m	6.00	6.00	7.50	UDS	-	-	-			
	6.0	93.876			Dark blackish brown, fine to very fine grained, silty clays of high plasticity (CH) 7.40 to 8.50m		6.50	6.50	7.50	UDS	-	-	-			
	6.5	93.376				Blackish brown, fine to medium grained, clayey sand with occasional gravels (SC) 8.50 to 10.20m	7.00	7.00	9.00	SPT	12	14	15			
	7.0	92.876			Blackish brown, fine to medium grained, clayey sand with occasional gravels (SC) 8.50 to 10.20m		7.50	7.50	9.00	SPT	12	14	15			
	7.5	92.376				Dark blackish, fine to coarse grained, poorly graded sand with much gravels (SP) 10.20 to 12.50m	8.00	8.00	10.00	DS	-	-	-			
	8.0	91.876			Dark blackish, fine to coarse grained, poorly graded sand with much gravels (SP) 10.20 to 12.50m		8.50	8.50	10.00	DS	-	-	-			
	8.5	91.376				Dark blackish, fine to coarse grained, poorly graded sand with much gravels (SP) 10.20 to 12.50m	9.00	9.00	10.00	DS	-	-	-			
	9.0	90.876			Dark blackish, fine to coarse grained, poorly graded sand with much gravels (SP) 10.20 to 12.50m		9.50	9.50	10.00	DS	-	-	-			
	9.5	90.376				Dark blackish, fine to coarse grained, poorly graded sand with much gravels (SP) 10.20 to 12.50m	10.00	10.00	11.00	SPT	19	26	22			
	10.0	89.876			Dark blackish, fine to coarse grained, poorly graded sand with much gravels (SP) 10.20 to 12.50m		10.50	10.50	11.00	SPT	19	26	22			
	10.5	89.376				Dark blackish, fine to coarse grained, clayey gravels with pebbles (GC)	11.00	11.00	12.00	DS	-	-	-			
	11.0	88.876			Dark blackish, fine to coarse grained, clayey gravels with pebbles (GC)		11.50	11.50	12.00	DS	-	-	-			
	11.5	88.376				Dark blackish, fine to coarse grained, clayey gravels with pebbles (GC)	12.00	12.00	13.00	SPT	18	16	17			
	12.0	87.876			Dark blackish, fine to coarse grained, clayey gravels with pebbles (GC)		12.50	12.50	13.00	SPT	18	16	17			
	12.5	87.376				Dark greyish brown, fine to coarse grained, clayey sand with little gravels (SC)	13.00	13.00	14.00	DS	-	-	-			
	13.0	86.876			Dark greyish brown, fine to coarse grained, clayey sand with little gravels (SC)		13.50	13.50	14.00	DS	-	-	-			
	13.5	86.376				Dark greyish brown, fine to coarse grained, clayey sand with little gravels (SC)	14.00	14.00	15.00	SPT	19	23	24			
	14.0	85.876			Dark greyish brown, fine to coarse grained, clayey sand with little gravels (SC)		14.50	14.50	15.00	SPT	19	23	24			
	14.5	85.376				Dark greyish brown, fine to coarse grained, clayey sand with little gravels (SC)	15.00	15.00	16.50	DS	-	-	-			
	15.0	84.876			Dark greyish brown, fine to coarse grained, clayey sand with little gravels (SC)		15.50	15.50	16.50	DS	-	-	-			
	15.5	84.376				Brownish, fine to coarse grained, clayey gravels (GC) 18.00 to 20.00m	16.00	16.00	17.00	UDS	-	-	-			
	16.0	83.876			Brownish, fine to coarse grained, clayey gravels (GC) 18.00 to 20.00m		16.50	16.50	17.00	UDS	-	-	-			
16.5	83.376	Brownish, fine to coarse grained, clayey gravels (GC) 18.00 to 20.00m	17.00	17.00		18.00	SPT	9	19	45	64					
17.0	82.876		Brownish, fine to coarse grained, clayey gravels (GC) 18.00 to 20.00m	17.50	17.50	18.00	SPT	9	19	45	64					
17.5	82.376	Brownish, fine to coarse grained, clayey gravels (GC) 18.00 to 20.00m		18.00	18.00	19.00	DS	-	-	-	-					
18.0	81.876		Brownish, fine to coarse grained, clayey gravels (GC) 18.00 to 20.00m	18.50	18.50	19.00	DS	-	-	-	-					
18.5	81.376	Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI) 20.00 to 21.70m		19.00	19.00	20.00	SPT	23	24	28	52					
19.0	80.876		Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI) 20.00 to 21.70m	19.50	19.50	20.00	SPT	23	24	28	52					
19.5	80.376	Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI) 20.00 to 21.70m		20.00	20.00	21.00	DS	-	-	-	-					
20.0	79.876		Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI) 20.00 to 21.70m	20.50	20.50	21.00	DS	-	-	-	-					
20.5	79.376	Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI) 20.00 to 21.70m		21.00	21.00	22.00	SPT	51	-	-	>100					
21.0	78.876		Dark brownish, fine to very fine grained, silty clays of intermediate plasticity (CI) 20.00 to 21.70m	21.50	21.50	22.00	SPT	51	-	-	>100					
21.5	78.376	Brownish black, fine to coarse grained, clayey gravels (GC)		22.00	22.00	23.00	DS	15cm	-	-	-					
22.0	77.876		Brownish black, fine to coarse grained, clayey gravels (GC)	22.50	22.50	23.00	DS	15cm	-	-	-					
22.5	77.376	Brownish black, fine to coarse grained, clayey gravels (GC)		23.00	23.00	24.00	SPT	51	-	-	>100					
23.0	76.876		Brownish black, fine to coarse grained, clayey gravels (GC)	23.50	23.50	24.00	SPT	51	-	-	>100					
23.5	76.376	Brownish black, fine to coarse grained, clayey gravels (GC)		24.00	24.00	25.50	DS	15cm	-	-	-					
24.0	75.876		Brownish black, fine to coarse grained, clayey gravels (GC)	24.50	24.50	25.50	DS	15cm	-	-	-					
24.5	75.376	Brownish black, fine to coarse grained, clayey gravels (GC)		25.00	25.00	26.00	SPT	54	-	-	>100					
25.0	74.876		Brownish black, fine to coarse grained, clayey gravels (GC)	25.50	25.50	26.00	SPT	54	-	-	>100					
25.5	74.376	Brownish black, fine to coarse grained, clayey gravels (GC)		26.00	26.00	27.00	DS	15cm	-	-	-					
26.0	73.876		Brownish black, fine to coarse grained, clayey gravels (GC)	26.50	26.50	27.00	DS	15cm	-	-	-					
26.5	73.376	Brownish black, fine to coarse grained, clayey gravels (GC)		27.00	27.00	28.00	SPT	68	-	-	>100					
27.0	72.876		Brownish black, fine to coarse grained, poorly graded gravels (GP)	27.50	27.50	28.00	SPT	68	-	-	>100					
27.5	72.376	Brownish black, fine to coarse grained, poorly graded gravels (GP)		28.00	28.00	29.00	DS	4cm	-	-	-					
28.0	71.876		Brownish black, fine to coarse grained, poorly graded gravels (GP)	28.50	28.50	29.00	DS	4cm	-	-	-					
28.5	71.376	Brownish black, fine to coarse grained, poorly graded gravels (GP)		29.00	29.00	30.00	DS	4cm	-	-	-					
29.0	70.876		Brownish black, fine to coarse grained, poorly graded gravels (GP)	29.50	29.50	30.00	DS	4cm	-	-	-					
29.5	70.376	Brownish black, fine to coarse grained, poorly graded gravels (GP)		30.00	30.00	30.25	DS	4cm	-	-	-					
30.0	69.876		Brownish black, fine to coarse grained, poorly graded gravels (GP)	30.00	30.00	30.25	DS	4cm	-	-	-					
		Brownish black, fine to coarse grained, poorly graded gravels (GP)		30.00	30.00	30.25	DS	4cm	-	-	-					
			Brownish black, fine to coarse grained, poorly graded gravels (GP)	30.00	30.00	30.25	DS	4cm	-	-	-					

Project : Proposed structures in 1X51 MW CCCP Plant of ONGC at Hazira for BHEL

Bore Hole No. : 15

Date of Start: 21/8/15

Co ordinates of Bore Hole : N 793.4, E 1762.7 m

RL of Ground : 99.790m

Date of Completion: 22/8/15

Machine and bit Used : Calyx machine fitted with cross blade clay cutter and saw tooth bits

Diameter of Bore : 150mm

Depth of Water Table : Observed at 2.00m depth on 72 hrs of drilling completion

Depth of Termination : 30 m

BORE LOG DATA SHEET

Method of Boring	Depth m	RL m	Casing	Notation	Soil Description	Depth of Sample m	Drill Run		Type of Sample	SPT N value / Penetration				FBD/FDD gm/cc	NMC %	Remarks
							From	To		N ₁	N ₂	N ₃	N			
							m	m								
Rotary Drilling by mud circulation	0.0	99.790	Not Used		Dark brownish, fine to very fine grained, filled up clays of low plasticity with debris 0.00 to 1.90m	0.00	0.00	1.50	DS	-	-	-	-	-	-	
	0.5	99.290				1.50	1.50	3.00	SPT	3	5	6	11	-	-	
	1.0	98.790														
	1.5	98.290			Dark brownish, fine to very fine grained, silty clays of high plasticity (CH) 1.90 to 4.70m	3.00	3.00	4.50	UDS	-	-	-	-	1.79 / 1.40	27.45	
	2.0	97.790														
	2.5	97.290														
	3.0	96.790														
	3.5	96.290														
	4.0	95.790			Blackish brown, fine to medium grained, silty sand with little plastic fines (SM) 4.70 to 7.50m	4.50	4.50	6.00	DS	-	-	-	-	-	-	
	4.5	95.290														
	5.0	94.790														
	5.5	94.290														
	6.0	93.790														
	6.5	93.290			Dark black, fine to medium grained, silty sand (SM) 7.50 to 11.20m	6.00	6.00	7.50	SPT	10	13	14	27	-	-	
	7.0	92.790														
	7.5	92.290														
	8.0	91.790														
	8.5	91.290														
	9.0	90.790			Dark brownish, fine to coarse grained, clayey sand with occasional gravels (SC) 11.20 to 14.00m	9.00	9.00	10.50	SPT	12	13	17	30	-	-	
	9.5	90.290														
	10.0	89.790														
	10.5	89.290														
	11.0	88.790														
	11.5	88.290			Blackish brown, fine to coarse grained, clayey gravels (GC) 14.00 to 22.10m	12.00	12.00	13.50	SPT	5	15	21	36	-	-	
	12.0	87.790														
	12.5	87.290														
	13.0	86.790														
	13.5	86.290														
	14.0	85.790			Blackish brown, fine to coarse grained, clayey gravels (GC) 22.10 to 28.00m	13.50	13.50	15.00	DS	-	-	-	-	-	-	
	14.5	85.290														
15.0	84.790															
15.5	84.290															
16.0	83.790															
16.5	83.290															
17.0	82.790															
17.5	82.290															
18.0	81.790															
18.5	81.290															
19.0	80.790	Blackish brown, fine to coarse grained, poorly graded sand with much gravels (SP) 28.00 to 30.0m	19.50	19.50	21.00	UDS	-	-	-	-	2.10 / 1.85	13.49				
19.5	80.290															
20.0	79.790															
20.5	79.290															
21.0	78.790															
21.5	78.290	Blackish brown, fine to coarse grained, clayey gravels (GC) 28.00 to 30.0m	21.00	21.00	22.50	SPT	13	34	41	75	-	-				
22.0	77.790															
22.5	77.290															
23.0	76.790															
23.5	76.290															
24.0	75.790	Blackish brown, fine to coarse grained, poorly graded sand with much gravels (SP) 28.00 to 30.0m	24.00	24.00	25.50	DS	-	-	-	-	-	-				
24.5	75.290															
25.0	74.790															
25.5	74.290															
26.0	73.790															
26.5	73.290	Blackish brown, fine to coarse grained, clayey gravels (GC) 28.00 to 30.0m	27.00	27.00	28.50	DS	-	-	-	-	-	-				
27.0	72.790															
27.5	72.290															
28.0	71.790															
28.5	71.290															
29.0	70.790	Blackish brown, fine to coarse grained, clayey gravels (GC) 28.00 to 30.0m	28.50	28.50	30.00	DS	-	-	-	-	-	-				
29.5	70.290															
30.0	69.790													Drilling terminated at planned depth.		