



# NIKETAN CONSULTANTS

SURVEY, CADD, GEO-TECH, GIS & PROJECT MANAGEMENT CONSULTANTS  
AN ISO 9001 : 2015 Certified Company

Ref: NC/SRY/2022-23/ 848

Date: 1.04.2022

To,  
The Executive Engineer,  
Major Works Division,  
PTCL,  
Vijayapura.

Inward No: 28

Date: 4/4/2022

M.W. Division, VIDYAPURA

Dear Sir,

Sub: 1) Report on conducting Geo-Technical Investigation Report for the Proposed 2x100mva, 220/110/11KV Chadachana (Devaranimbaragi) S/S in Chadachan Taluk, Vijayapur District.  
**Submission of Geo-Technical Report (6set) -reg.**

2) Conducting modern line survey for construction of 110KV SC line on DC towers from proposed 220/110/11KV Chadachan (Devaranimbaragi) Substation to proposed 110KV Jigajeevani substation for a distance of 5.741kms in Indi Taluk Vijayapur District. **Submission of Detailed survey report with profile drawing (1 set) -reg.**

3) Conducting modern line survey for construction of 110KV LILO line from existing 110KV Zalaki-Chadachan line to proposed 220/110/11KV Chadachan (Devaranimbaragi) substation for a distance of 8.313kms in Indi Taluk Vijayapur District. **Submission of Detailed survey report with profile drawing (1 set) -reg.**

We are here with submitting the **Geo-Technical Report, Detailed survey report with profile drawing** of the above said works.

Please acknowledge the same

Assuring you of our good - cooperation & best services at all times

Thanking you,

Yours faithfully,

For NIKETAN CONSULTANTS,



Authorised Signatory

# CLIENT

## KARNATAKA POWER TRANSMISSION CORPORATION LIMITED

### GEO-TECHNICAL REPORT ON

REPORT ON CONDUCTING GEO-TECHNICAL INVESTIGATION FOR THE  
PROPOSED 2X100MVA, 220/110/11KV CHADACHANA (DEVARANIMBARAGI)  
IN CHADACHAN TALUK, VIJAYAPUR DISTRICT. SBC = 18.64 Sq. mt.

### M/s. NIKETAN CONSULTANTS

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**REPORT ON CONDUCTING GEO-TECHNICAL INVESTIGATION FOR THE  
PROPOSED 2X100MVA, 220/110/11KV CHADACHANA (DEVARANIMBARAGI)  
S/S IN CHADACHAN TALUK, VIJAYAPUR DISTRICT.**

**GENERAL:**

The authorities of KPTCL, proposed to construct 220/11 KV Substation Chadachan in Chadachan Taluk, Vijayapur District. on whose 'authority' and 'specification' we conducted this geotechnical investigation.

**SCOPE OF INVESTIGATION:**

The geotechnical investigation program was planned as per the scope of work furnished to us and also the time to time instruction of the 'authorities' and also the field conditions / site conditions after interaction with the 'authorities.'

01. A reconnaissance study was undertaken to make a rough assessment about logistics for the mobilization of men and material for conducting geotechnical investigation, subsoil conditions, site conditions and to plan subsoil exploration.

02. The borehole locations were decided by the 'authorities' considering the position of the proposed structures in the site and the same sunk to a depth of 6.00 m or "Refusal strata" which ever comes earlier. Disturbed samples ( representative samples from the flutes of the auger bit and split spoon sampler ) and undisturbed samples using thin walled samplers were extracted at regular depth intervals of 1.00 was established on the ground by our field staff.

03. At specified locations either trial pits or boreholes using manually operated helical auger of 100 mm diameter were sunk to a depth of 6.00 m or "Refusal strata" which ever comes earlier. Disturbed samples ( representative samples from the flutes of the auger bit and split spoon sampler ) and undisturbed samples using thin walled samplers were extracted at regular depth intervals of 1.00 m or wherever the strata changes. Sampling was done as per IS:2132-1986. The UDS thus collected were applied with molten wax at either ends of sampling tubes, labeled and covered in polythene bags and rubber bands and sent to the laboratory for testing. In case of granular deposit ( sandy or gravelly formation ), weathered rock formations, very stiff fissured and desiccated clays or very soft sensitive clays it would not be possible to extract undisturbed soil samples and in such cases only representative disturbed samples may be collected for determining the index properties of soil to aid identification and classification tests. Strength and compressibility tests on remolded specimens can be unreliable and hence the field tests like SPT would be a preferable option.

Also SPT tests were conducted in the boreholes at regular depth intervals of 1.50m staggering with sampling levels. This tests involves observing number of blows from a standard drop weight weighing 63.5 Kg falling freely through a height of 750 mm and there by causing penetration of split spoon sampler at the bottom of the boreholes for a length of 450 mm. The number of blows for the first 150 mm penetration was



disregarded for the purpose of seating, however the number of blows for the last 300 mm penetration was counted and reported as 'N' Values. Thus obtained field 'N' values were applied with correction for overburden and dilatancy (correction for dilatancy only in case of saturated silts) and in accordance with IS recommendations and these corrected N values were averaged for the entire 'Significant depth' and this characteristic value of the borehole was interpreted as per IS : recommendations to obtain allowable bearing pressure.

04. Ground water table observation were made in the test pits/ boreholes or near by water bodies like open well or pond and also enquires were made regarding the same for the probable critical raise during monsoon

05. Bearing capacity analysis and settlement analysis were carried out as per the following codes .

- a) IS:8009-PART -1- 1993
- b) IS:6403-1981

#### **The main objective of this investigation:**

- a) To suggest a suitable foundation system, to rest the structure on.
- b) To recommend an appropriate depth to rest the foundation.
- c) To determine the allowable bearing pressure at the recommended depth for the type of foundation suggested.
- d) To estimate the nature and magnitude of probable settlement due to load of the structure on subsoil.
- e) To see & warn of any problems due to subsoil conditions, that could arise at the foundation construction stage.

#### **THE STRUCTURE :**

The proposed construction will be comprised of a office building which is reinforced cement concrete framed structure with a ground floor and provision for one upper floor. The loading on the subsoil due to the proposed construction is expected to be uniform .

#### **THE SUBSOIL CONDITIONS :**

The subsoil conditions at the site as per observations made during subsurface exploration and also from the results of laboratory & field test results indicate a fair degree of non uniformity only at shallow depths between the four boreholes, chosen for intensive investigation compelling the most critical soil condition to be taken as basis for a general and overall conception and conclusion with regards to an appropriate type , depth of substructure / foundation system for the proposed structures. The shear parameters obtained directly from shear tests on remolded specimens in direct shear tests.

**GROUND WATER TABLE:**

The ground water table was not encountered in any of the boreholes at the time of investigation and however its effect has been factored in the bearing capacity analysis with due consideration for critical monsoon.

**THE INVESTIGATION PROGRAMME:**

Four spots were chosen for intensive investigation as decided by the clients. At these spots trial pits / 100 mm diameter boreholes were sunk to a depth of 6.00 m with respect to existing ground level, using manually operated helical augers. Soil samples were taken from boreholes (using thin shellby tubed samplers) and disturbed samples at various depths in the borehole. Standard Penetration Tests were done at the bottom of boreholes. The results of the laboratory tests and 'N' values from SPT were used to compute the soil parameters required for footing design, by IS : 6403 - 1981/ IS: 8009-part I 1976 bearing capacity analysis. Following laboratory tests were carried out on soil samples.

- a) Bulk density and moisture content
- b) Sieve analysis
- c) Hydrometer analysis
- d) Liquid limit and plastic limit
- e) Shrinkage limit
- f) Specific Gravity
- g) Standard proctor test
- h) Swell pressure
- i) Free swell index
- j) Unconfined compressive strength
- k) Triaxial shear test
- l) California Bearing Ratio

The Results of the above tests are tabulated in Table - No - 1 to 3

**DATUM:** All the levels in this report are referred with respect to existing ground level taken as datum i.e. 0.00 m



TABLE NO.1

Technical Investigation of soil for Proposed site of 220/11 KV Substation Chadachan in Chadachan Taluk, Vijayapur District.

Place Name	Bore hole point	Depth in m	standard penetration or <u>N value</u>	Physical description of soil
Chadachan in Chadachan Taluk, Vijayapur District.	BH-1	1.1	12	Reddish Soil
	BH-2	2.2	09	Reddish Soil
	BH-3	1.5	15	Reddish Soil
	BH-4	2.0	12	Reddish Soil
	BH-5	3.2	14	Reddish Soil
	BH-6	1.1	10	Reddish Soil
	BH-7	1.5	18	Reddish Soil
	BH-8	2.10	20	Reddish Soil

**TABLE NO. 2**  
**INDEX AND ENGINEERING PROPERTIES OF SOIL**

SL. NO.	PARTICULARS	BH-1 (D-1.1m)	BH-2 (D-2.2m)	BH-3 (D-1.5m)	BH-4 (D-2.0m)	BH-5 (D-3.2m)	BH-6 (D-1.1m)	BH-7 (D-1.5m)	BH-8 (D-2.1m)
01	Specific Gravity ( $G_{27^0}$ )	2.82	2.50	2.72	2.62	2.70	2.55	2.48	2.67
02	In situ bulk density, ( $\gamma_b - \text{kN/m}^3$ )	20.42	21.12	21.41	20.45	20.62	20.47	20.55	21.63
03	Natural Moisture Content, ( $w\%$ )	6.20	6.28	5.35	6.42	5.27	6.14	6.35	6.84
04	In situ dry density, ( $\gamma_d - \text{KN/M}^3$ )	19.25	20.12	19.54	20.15	20.36	18.36	18.47	18.28
05	Grain size Distribution Analysis. Texture: Gravel %; Sand %; Hydrometer analysis: Silt %; Clay %;	08 58 20 14	12 62 18 08	13 56 20 11	15 52 18 15	18 55 12 15	12 60 18 10	10 56 15 19	12 58 16 14
06	Atterberg limits & indices Liquid limit ( $W_L\%$ ) Plastic limit ( $W_P\%$ ) Plasticity Index ( $I_P\%$ )	34 15 19	29 12 17	38 18 10	36 18 18	30 12 18	28 15 13	32 18 14	33 15 18
07	Shrinkage Limit, $W_s(\%)$	4.2	4.9	5.2	5.6	4.2	4.8	5.0	5.5
08	Swell Pressure, (%)	10	08	12	13	15	10	18	16
09	One dimensional Consolidation test Compression index, $C_c$	--	--	--	--	--	--	--	--
10	UCS Unconfined compressive strength, $\text{kN/m}^2$	265	295	285	270	285	260	265	295
11	Triaxial Compression Test: Cohesion ( $C - \text{kN/m}^2$ ) Friction angle ( $\phi'$ )	10 23 <sup>0</sup>	08 25 <sup>0</sup>	15 18 <sup>0</sup>	12 20 <sup>0</sup>	22 15 <sup>0</sup>	16 12 <sup>0</sup>	18 10 <sup>0</sup>	19 20 <sup>0</sup>
12	Classification (ISSCS) IS: 1498 - 1970	SW-SC	SW-SC	SW-SC	SW-SC	SW-SC	SW-SC	SW-SC	SW-SC

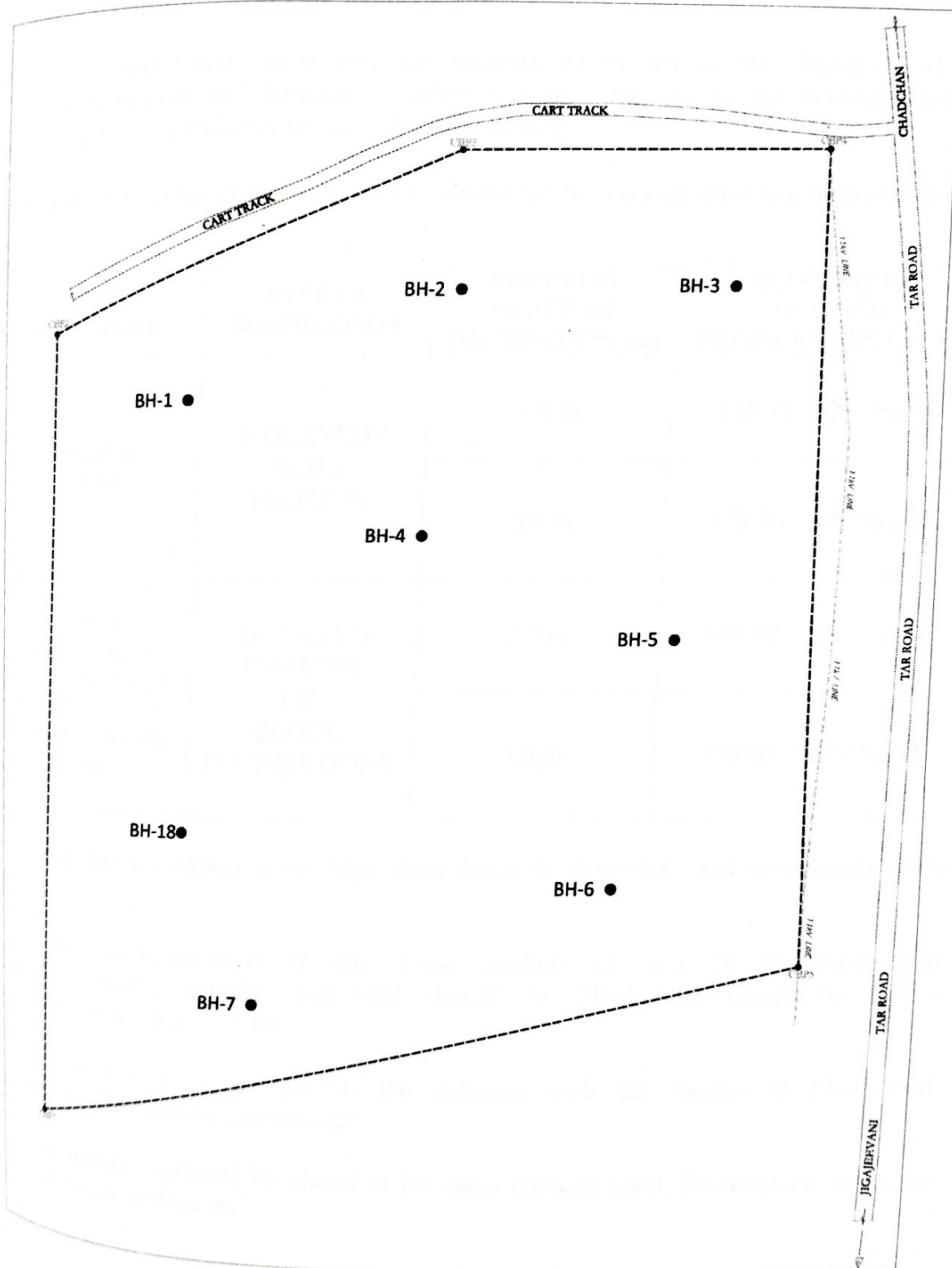
TABLE NO:3

## RESULTS OF STANDARD PROCTOR DENSITY TESTS AND C.B.R TESTS

B.H.NO	DEPTH (M)	MAXIMUM DRY DENSITY (kN/M <sup>3</sup> )	OPTIMUM MOISTURE CONTENT (%)	C.B.R (%)
1	1.5	23.4	10.5	11.6
2	1.5	22.5	9.4	14.6
3	1.5	23.1	10.5	10.5
4	1.5	22.4	8.6	9.8
5	1.5	20.1	11.3	10.2
6	1.5	23.4	10.8	8.2
7	1.5	23.5	9.2	9.7
8	1.5	22.8	11.8	9.4



**LOCATION OF BOREHOLE POINTS:**



**CONCLUSIONS AND RECOMMENDATIONS:**

01. The bearing stratum is Yellowish brownish silty sandy soil and continuing further down and turning to acquire more compactness, and cementation & structured, which get classified as SW-SC, SC as per ISSCS.

02. The ground water table was not encountered in any of the boreholes at the time of investigation and however its effect has been factored in the bearing capacity analysis with due consideration for critical monsoon.

03. Following foundation system is recommended for the various structures proposed in the site.

Sl. No	THE STRUCTURE	TYPE OF FOUNDATION	MINIMUM DEPTH OF FOUNDATION (m)	ALLOWABLE BEARING PRESSURE (kN / Sq M)
01.	CONTROL ROOM	ISOLATED / WALL FOOTING	2.0 m	210.75 kN / Sq M
			3.0 m	178.00 kN / Sq M
02.	OTHER STRUCTURES (TRANSFORMERS & COLUMNS OF SUPPORT FRAME WORK)	ISOLATED FOOTING OR BLOCK FOUNDATIONS	2.0 m	169.00 kN / Sq M
			3.0 m	190.00 kN / Sq M

\* with due consideration for high shear loads & moments and consequent uplift resistance.

03 At the foundation level if any loose pockets of soil is encountered, it should be removed entirely and void should be filled with compacted sand / gravel mixture or lean concrete.

04. It is recommended to tie all the columns with RC beams at Plinth level both ways for the control room structure.

05. All the foundation should be placed at the same reduced level, Foundations are to be designed for equal settlements.



06. Isolated footings are recommended at the depth of 2.0m (i.e., 6.5 feet) below the Existing Ground Level. It is recommended to excavate up to 2.4m from ground level and Backfilled with compacted boulders and sand/quarry dust up to 2.0m depth from existing ground level, and over this 100mm Sand-Cement (10:1) Pad compacted in two layers. Foundation shall be rested on compacted boulders and M-sand/quarry dust fill.

07. Seepage water was found in boreholes during investigation. If there is water proper dewatering method should be adopted during foundation excavation. Hence, adequate precautions must be taken against the collapse of the sides of foundation pits of the proposed structure. This can be done by providing adequate shoring and support or proper slope.

08. It is recommended that the back filling in the foundation should be carried out with proper compaction.

09. Backfilling should be done with Cohesive Non-Swelling (CNS) soil.

**APPENDIX - I****CALCULATION OF SAFE BEARING CAPACITY AS PER IS: 6403 1981**

$$q_{nu} = c N_c S_c d_{cic} + \gamma D (N_q - 1) s_q d_q I_q W' + 0.5 \gamma B N_r s_r d_{rI} W''$$

where  $q_{nu}$  = net ultimate bearing capacity.

$C$  = cohesion

$N_r, N_q, N_c$  = bearing capacity factors

$s_c, s_q, s_r$  = shape factors ( 1.3, 1.2 & 0.8 resp for square footings)

$d_c, d_q, d_r$  = depth factors

$I_q, I_r$  = inclination factors (0.8, 0.8 & 0.5 resp for load inclination of 100)

$W', W''$  = ground water table reduction factors

$\Gamma$  = unit weight of soil

$D, B$  = depth and width of foundation

For the above for square isolated footing substituting,  $C = 10.0$ ,  $\Phi = 22^\circ$ ,  $\gamma = 19.81 \text{ kN/Sq m}$ ,  $N_c = 5.14$ ,  $N_q = 1$ ,  $N_r = 18.50$ ,  $s_c = 1.3$ ,  $s_q = 1.2$ ,  $s_r = 0.8$ ,  $d_q = d_r = 1.2$ ,  $D = 2.00 \text{ m}$ ,  $B = 1.50 \text{ m}$ ,  $W' = 0.5$  & for factor of safety 3.0 the Safe Bearing Capacity  $q_u = 186.40 \text{ kN/Sq m}$ .





SITE PHOTOS:

CHADACHANA (DEVARANIMBARAGI)

