

DELHI DEVELOPMENT AUTHORITY  
OFFICE OF THE CHIEF ENGINEER (DESIGN)  
CENTRAL DESIGN ORGANIZATION

No:CE(D)TC)13)2005/CDO/372

Dated:31.5.06

CIRCULAR No.28

**Sub: Basic Soil Parameters for Soil Investigation for Construction of Buildings in DDA.**

Regarding Soil Investigation works, due attention is not being given by the field Engineers, thereby causing large delays in taking up of new projects. This circular is a reminder to the circulars already issued by CDO, in this connection.

Enclosed is the Preliminary Basic Data required for Soil Investigation. From the perusal of the Data it may be seen that broad aspects of Soil Parameters have been identified to be investigated. However, all Field Engineers are free to conduct any other relevant Test deemed necessary or the extent of the depth of Exploration if deemed essential during the Investigation.

The Type Design of the Foundation shall be decided on the basis of the Recommendations received from the Soil Consultant after scrutinizing relevant Soil Data. The scope of the work must include that the Consultant may have to interact with CDO for finalisation of soil report.

All Engineers are free at their level to add any other information according to the site conditions so that, appropriate Investigations are conducted in the manner stipulated in the relevant IS Code.

Chief Engineers/Superintending Engineers are requested to ensure that field staff follows these instructions meticulously for the soil investigation works.

  
(R.C. KINGER)

CHIEF ENGINEER (DESIGN)

Copy to:

1. EM/DDA for information please.
2. All Chief Engineers/DDA.
3. All Suptdg. Engineers/DDA.
4. EE(D)I to EE(D)VI/CDO.

  
CHIEF ENGINEER (DESIGN)

**PRELIMINARY BASIC DATA REQUIRED FOR SOIL  
INVESTIGATION FOR BUILDINGS**

1. **INVESTIGATIONS :-**

**IN-SITU TESTS :**

i) **DCP TESTS :**

DCP tests shall be conducted according to IS Code 4968 Pt.II and other related provisions in various codes. The size of the cone shall be strictly in accordance with the provisions of the IS code. DCP tests is mandatory for cohesive soil and can be treated optional for soil where Rocks, Boulders, Gravels etc. are apparently seen.

ii) **SPT TEST :**

The number of Bore Holes shall be decided on Block to Block basis. Block length shall be assumed between the Expansion Joint which is generally not more than 45 m. At least two Bore Holes shall be provided in each Block.

a) The number of Bore Holes may be increased/decreased depending upon topography/strata identified at the site. Bore hole in the open area within the block (if any) shall be avoided unless deemed necessary.

b) Depth of Exploration for structures where columns are closely spaced (Residential Buildings) shall be as per IS:1892.

i) **Isolated spread footings/Raft Foundations.**

Bore holes to be investigated below foundation level one and a half times the width of the block.

ii) **Piles / Well Foundation**

Depth of Exploration one and a half times the width of the structure below toe of pile.

c) Sub-soil water level shall be identified for each bore hole.

2. **SAMPLING :**

i) **UDS (Undisturbed Soil Sample) :**

UDS shall be collected at every change in the strata and or at intervals not exceeding 1.5 m within the continuous strata as prescribed in IS Code.

ii) **Plate load Test :**

The Plate load Test shall be conducted as per relevant IS Code wherever deemed necessary.

- iii) **Chemical Test :**  
The Chemical Test of the Soil and Sub-soil water shall be got conducted to identify the presence of injurious chemicals if any, deemed harmful for the Pile/Raft. Chlorides and SO<sub>3</sub> shall be tested for soils and water as per clause 5.4 and 8.2.2.4 of IS 456 : 2000.
- iv) **Any other Test :**  
Field Engineers are free to undertake / conduct any other relevant test deemed necessary considering the Topography and or the Soil Strata according to the site condition.

3. **LABORATORY TESTS :**

- i) All relevant Laboratory Test as are stated in relevant IS code shall be done to work out values in respect of :
  - a) C, Ø, Void Ratio, Liquid Limit, Plastic Limit, Sp.Gr., Dry Density, Sat. Density, Bulk Density, Natural Moisture Content and Soil classification etc.
  - b) In case of Clay Soil, parameters with Ce(compression Index), m<sub>v</sub> coeff. Of volume change, Unconfined Compressive Strength etc. shall be worked out and calculations attached with the report.

4. **ASSESSMENT OF SBC :**

The SBC shall be worked out at various levels given as under :-

- i) At the anticipated depth of the Foundation for building blocks and below the level of the Lift well, as applicable.
- ii) Basement level if proposed in the Plan.
- iii) All the calculations in accordance to the relevant provision of IS Codes shall be worked out and attached with the Report. The Net and Gross Safe Bearing Pressure shall be worked out both according to Shear and also according to Settlement Criteria.
- iv) **Modulus of Sub-grade Reaction :**  
The Horizontal as well as Vertical Modulus of Sub-grade Reaction shall be worked out from the actual Field Tests like Plate Load Test or any other appropriate Test with shape and size corrections.

5. **PRESENTATION OF THE REPORT :**

The report shall include :

- i) Layout Plan showing the Bore holes and Neighbouring Structures. Features like Drains, Ponds if existing within the Plot/adjacent to the Plot shall also be shown in the Plan.
- ii) Appropriate Contour Plan shall be prepared particularly wherever the Ground is undulated.
- iii) Proposed Super Structure Plan shall be imposed on the Site Plan. The location of Bore holes and position of SPT/DCP Test shall be indicated in the Plan.
- iv) A Sketch showing the Elevations of the Ground Levels, Finished Levels, Proposed Plinth Level, proposed Foundation Level shall be attached. All levels shall be referred with respect to relevant GTS Bench Mark.
- v) Grain size distribution graphs shall be invariably attached.
- vi) Bore Log Charts for each Bore hole showing the levels at which the samples were collected in the Format as shown in IS Code 1892 shall be attached.
- vii) Graphical presentation of SPT/DCP values for each Bore holes as prescribed in the relevant IS Code shall be attached.
- viii) Integrated graph showing the SPT Values for each Bore holes to give idea of Soil Profile/Subsoil Water Level to be plotted with common Datum with reference to GTS Mark.

6. **DISCUSSION :**

The Consultant shall evaluate results in the manner deemed fit by him and he shall offer appropriate comments on the results identified and also technically explain the various variation in the results if any. The discussion shall include comments regarding :-

- i) Co-relation between the values of SPT and DCP Tests conducted at different depths.

- ii) Co-relation between Field Value 'N' and the Laboratory Values of Density, Void Ratio,  $\phi$  etc.
- iii) Co-relation between Clay content and the value of C (Cohesion).
- iv) In case of the presence of the Clay content the anticipated effect on Structures shall be specifically discussed and mentioned. Any measures to contain adverse effects if any shall be spelt out.
- v) The anticipated effect if any with reference to salient features like Drain, Pond, filled up Soil, Rock, in the adjoining plot shall be discussed appropriately. The Field Engineers shall also obtain appropriate information of the Safe Bearing Capacity in the adjoining pocket if the same has been built up or is in the process of observation/development.

## 7. RECOMMENDATIONS :

The type of Foundation to be used shall be decided after obtaining clarifications or any other relevant Data deemed necessary at appropriate time in consultation with the consultant. Considering above the consultant shall recommend the Safe, Stable and Economic Types of foundation at the appropriate Depth both for columns in respect of Frame Structure and/or shear walls if provided with reference to the Provisions of relevant IS Codes.


- a) **Raft Foundation** : In case Raft Foundation is recommended the relevant calculations in accordance with the provisions of IS Code shall be attached. Modulus of subgrade reaction as per plate load test with shape and size correction shall be given.
- b) **Pile Foundation** : In case the Pile Foundation is recommended the details as given below shall be part of the report.
  - i) **Type of Piles Bored/Driven**  
The type of the pile shall be specified with reference to IS 2911 Pt.1 (Sec.1 to 4).
  - ii) **Capacity of the Pile :**  
The Capacity of the Pile shall be worked out according to the relevant IS Codes for compression, uplift, lateral loads. The recommendations shall include Length, Diameter etc. for the piles considering grade of concrete mix as M<sub>35</sub>.

- iii) The resistance to horizontal forces (lateral load carrying capacity) shall be worked out alongwith depth of fixity as per relevant IS Code.
- iv) Effect of Negative Skin Friction if any shall be elaborated.

8. **GENERAL :**

- i) The nature and the Classification of the Cement to be used in the raft/Pile/Pile Caps/Grade Beams consistent with Soil Parameters shall be recommended.
- ii)  $C_U$  and  $C_C$  shall be evaluated at the initial stage in case of loose SP Soils, where water table is high, so as to check the possibility of liquefaction, if any.
- iii) Engineer incharge shall ensure that Soil Investigation report is forwarded to CDO by the Chief Engineer (Zone) along with recommendations and Soil data, as required in the Design proforma. Details such as SBC, type of foundation adopted in the adjacent areas and maximum level of water table expected to rise during life time of the structure etc. shall be given.
- iv) Contents of the Soil Investigation report shall be authenticated by the field staff.

The Consultant with the prior approval of Engineer-incharge shall be free to conduct any other Field/Laboratory Test to determine and to include any other relevant vital information in his report to justify the Type of Foundation being recommended considering various existing Provisions of IS Code.



(R.C. KINGER)

CHIEF ENGINEER (DESIGN)

REQUISITION FOR DESIGN WORK  
PROFORMA CUM CHECK LIST

1. Name of Work
2. Name of Circle
3. Present position of Work:
  - i) AA & ES  
Reference No.
  - ii) Technical sanction  
(Indicate special structural provisions made in the T.S.)
  - iii) Availability of land
4. Name of Division
5. Soil Investigation Report  
(Attach an authenticated copy)
  - i) Whether subsoil, water level indicated
  - ii) Whether water table likely to rise during the life of the building? If yes, indicate the level.
  - iii) Whether the bore holes are connected to a common bench mark, if not, this may be done.
  - iv) All bore holes data to be represented in one sheet with reference to a common datum indicating soil parameters C,  $\phi$ , N values.  
(attach such a representation with soil report.
  - v) Has the recommended bearing capacity of the soil been supported with calculations?
  - vi) Whether recommended bearing capacity is available for foundation width 0.9M to 2.4M.

- vii) Has the consultant recommended any special type of foundation?
  - a) If the raft foundation is recommended the modulus of subgrade reaction is to be given with size & shape corrections.
  - b) If the pile foundation is recommended the type of pile and the load carrying capacities for different pile length and diameter are to be given with reference to compression, uplift lateral load alongwith depth of fixity.

Calculations on the basis of the Table of IS-2911(Part-III) and also on the basis of soil parameter as per relevant IS Code.

- 6. I) Indicate the safe bearing capacity adopted in the adjoining pockets and type of buildings constructed.
- 7. i) Attach a layout plan clearly indicating the depth of earth filling that would ultimately be done at the location of each and every block with respect of finished/formed ground levels.
  - ii) Minimum and maximum depths from plinth to foundation for each block likely during execution.
- 8. Three sets of Architectural working drawings and the layout.
- 9. Attach a layout plan of the total area super imposing the location of the bore-holes investigated.
- 10. Indicate any special feature of the site such as Open wells, ponds, ditches, abandoned sewers, Septic tanks, natural water sources etc.
- 11. Comments on the recommendations made by the Soil Consultants.