COMPUTER PROGRAMMING FOR SAFE BEARING PRESSURE AND SETTLEMENT CALCULATION OF FOOTING AS PER CODE USING VB-6.0

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Abstract: ***Geotechnical Engineers are concerned with ensuring adequate safety margin against shear failure of foundations by soil rupture. The process of deciding allowable bearing pressure for footings is iterative in nature as one has to satisfy both shear as well as settlement criteria. It is purposed to prepare a computer program for determination of safe bearing capacity of footing which satisfies settlement criteria. In this a program is prepared in VISUAL BASIC 6.0 due to its user friendly interface and ease to aesthetic appearance. Settlement estimation depending upon soil formation as per IS 8009(part I):1976 for isolated footings. Software for settlement criteria is also developed. Based on comparison of the calculated and permissible settlements, safe bearing pressure is calculated. Soil pressure is considered uniform for calculating settlement.***

Keywords: ***IS 8009(part I):1976 "Code of practice for calculation of settlements of shallow foundations"(Settlement criteria).***

I. INTRODUCTION

The most of the structures include building, earth fill concrete dams; it is earth that provides ultimate support. The bearing capacity of foundations is needed for dimensioning the foundation for any structure. Several methods are available for the determination of bearing capacity of shallow foundations and give some of the methods which are commonly used for the purpose. The various methods is applied to different problems of allowable bearing pressure.

Settlement may be the result of one or combinations of the following causes:

1. Static loading.
2. Deterioration of foundation.
3. Mining subsidence.
4. Shrinkage of soil, vibration, subsidence due to underground erosion and other causes.

Catastrophic settlement may occur, if the static load is excessive. When the load is not excessive, the resulting settlement may consist of the following components:

1. Elastic deformation or immediate settlement of foundation soil.
2. Primary consolidation of foundation soil resulting from the expulsion of pore water.
3. Secondary compression of foundation soil.
4. Creep of the foundation soil.

If a structure settles uniformly, it will not theoretically suffer damage, Irrespective of the amount of settlement. But, the underground utility lines may be damaged due to excessive settlement of the structure. In practice, settlement is generally non-uniform. Such non-uniform settlements induce secondary stresses in the structures. Depending upon the permissible extent of these secondary stresses, the settlements have to be limited. Alternatively, if the estimated settlements exceed the allowable limits, the foundation dimensions or the design may have to be suitably modified. Therefore, this code is prepared to provide a common basis, to the extent possible, for the estimation of the settlement of shallow foundations subjected to symmetrical static vertical loading. It is proposed to prepare a general purpose computer program in visual Basic 6.0 for the shallow foundation proportioning for the given soil strata, design shear strength parameters and compressibility parameters, the safe bearing pressure of the footing with reference to settlement criteria can be calculated using this program.

II. METHODOLOGY

In settlement criteria select geometry of the footing input the data according to the is code select any one type of case from following cases.

In settlement criteria select geometry of the footing input the data according to the is code select any one type of case from following cases,

1. A deposit of cohesion less soil resting on rock

Reference Book: Rao Gopal Ranjan A.S.R. âĂIJBasic and Applied Soil mechanics (Example 15.11, page 530)				
Type of footing	Square			
Depth	2 m			
Width	2.5 m			
Foundation pressure	166KN/m2			
Depth of ground water table	No ground water			
Unit weight of soil	17 KN/m2			
Factor of safety	2.5			
Depth (m)	1	2	1	1
Ckd (KN/mÂš)	3000	4000	7000	3000

Table 1:

2. A thin clay layer sandwiched between cohesion less soil layers or between cohesionless soil layer at top and rock at bottom.
3. A thick clay layer extending to ground surface and resting on cohesion less soil or rock.
4. A deposit of several regular soil layers

III. WORKED EXAMPLE FOR STATIC CONE PENETRATION TEST

1. INPUTS BY USER
   (a) Select Type of footing
   (b) Input Size of footing
   (c) Select 1st case (A deposit of cohesion less soil resting on rock)
   (d) Select Static cone penetration test
   (e) Input No. Of layers
   (f) Input Depth of layers
   (g) Input Static cone resistance Ckd
   (h) Input Foundation pressure
   (i) Input ground water table
2. Then click on the result it gives the settlement in mm.
3. Settlement at the center of each layer obtained by calculating effective overburden pressure 'Po' and incremental pressure by Boussinesq equation.
4. Then click on the 2nd button SBC for allowable 40mm it gives SBC for allowable 40 mm settlement.
5. For results of report click on the text file button.
6. For input new data click on New data button.

Solution:

$$St = 2.303\left(\frac{H_f}{C}\right)\cdot log\left[\frac{p_0 + \triangle p}{p_0}\right] \quad (1)$$

Numbers of layer = 4
Foundation Pressure = 166
Unit weight of soil = 17 kN/m^2
Thickness of soil layer H_f = 20m

Layer	H (mm)	qc	σ_0	C	$\Delta\sigma$	logσ_0 + $\Delta\sigma/\sigma_0$	S (mm)
1	1000	3000	42.5	105.9	159.4	0.677	14.7
2	2000	4000	68.0	88.2	74.4	0.321	16.7
3	1000	7000	93.5	112.3	33.2	0.132	2.7
4	1000	3000	110.5	40.7	21.9	0.078	4.4
Sum=38.5 mm							

Table 2:

Sr.No	Layer Depth (m)	Ckd (kN/m^2)	Po (kN/m^2)	Pressure Increment (kN/mm^2)
1	1	3000	42.5	165.19
2	2	4000	68.0	77.26
3	1	7000	93.5	34.54
4	1	3000	110.5	24.45

Table 3:

Settlement of foundation = 14.7+16.7+2.7+4.4 = 38.5 = 39 mm

Results from software

Settlement of foundation = 40 mm SBC for allowable 40 mm settlement = 172 kN/m^2

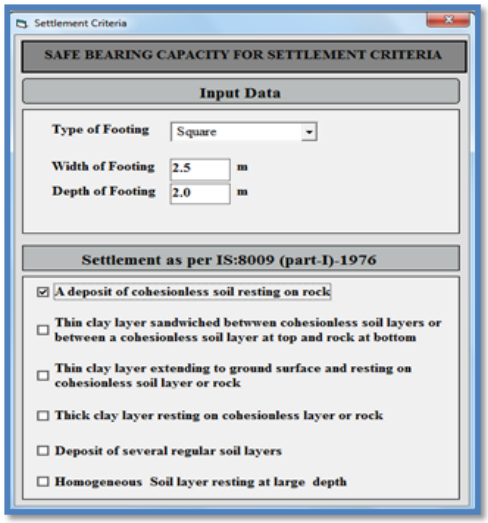

Figure 1: Input of example for static cone penetration test

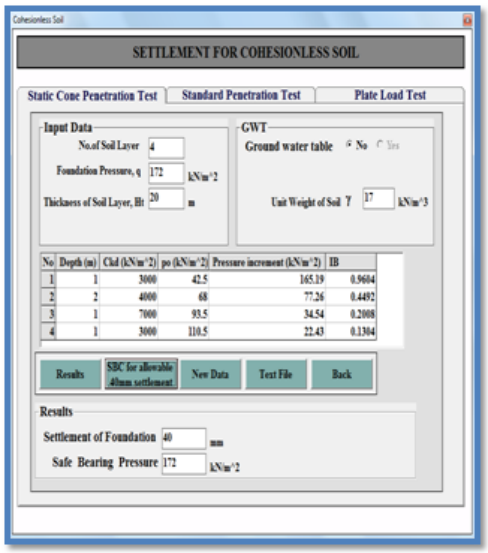

Figure 2: Output of example for static cone penetration test

IV. CONCLUSION

1. This computer program is versatile because, It gives the satisfactory solution for determination of safe bearing capacity of footing with shear and settlement criteria.
2. It considers different types of soil, footings and, size, various cases of depth of water table and its effects.
3. It also calculates pressure increment using Boussinesq equation and directly gives the ratio of settlement per unit pressure that is seen in chart given in code for SPT and directly gives the depth factor that is seen in chart given in code.

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