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Plate Load (Model) Test for Bearing Capacity of Layered Deposite

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ABSTRACT

Calculation of the ultimate bearing capacity of shallow footing on a two layered system of soil depends on the pattern of the failure surface that develops below the footing. For a siltysand (SM) layer overlaid by a clay layer (CI), assuming general shear failure or local shear failure pattern .By adapting this assumption in this study, the ultimate bearing capacity was derived as a function of the properties of soils, the footing width, and the top soil thickness. The paper presents a parametric study of the design parameter variable of ultimate bearing capacity for different layer ratio top and bottom layer is done.

Keywords : SM soil, CI soil, Bearing capacity, layered soil

INTRODUCTION

The function of a foundation is to transfer the load of the superstructure to the underlying soil formation without overstressing the soil. The soil must be capable of carrying the load for structure(s) placed upon it without shear failure and with the resulting settlement being tolerable for that structure. Many investigations on the subject of ultimate bearing capacity have been carried out during the past century. Subsequently, numerous proposals have been advanced regarding considerations, criteria, and procedures for evaluation of the ultimate bearing capacity of soils. Among the very early contributors were Prandtl (1921) who developed a solution for a surface strip footing over a perfectly plastic cohesive-frictional weightless half-space. Reissner (1924)extended the solution of Prandtl to include the effect of a uniform surcharge load on the resistance of penetration of ultimate applied load. Since real soils possess weight, Terzaghi (1943) was the first to introduce the concept of ultimate bearing capacity and presented a comprehensive theory for the evaluation of such capacity of shallow foundations. Subsequently, the bearing capacity theory went through many modifications to account for different features such as foundation shape, load inclination, ground slope, non symmetrical loads, and water table. The general bearing capacity theories proposed by Meyerhof (1963), Hansen (1970), Vesic (1973) and others are now routinely used in foundation design. The bearing capacity theories mentioned above involve cases in

which the soil supporting the foundation is homogeneous and extends to a considerable depth. However, in practice, layered soil profiles are often encountered. For layered clayey soil, Button (1953) was the first to analyse footings on layered soils of different cohesion. Many other studies were conducted for clayey layers including those of Sivareddy and Srinivasan (1967), Brown and Meyerhof(1969), Desai and Reese (1970a, b) and Merifield et al. (1999). In another case, many authors studied the bearing capacity of a sand layer overlaying a clay layer. These studies were conducted by Meyerhof (1974), Meyerhof and Hanna(1978), Hanna and Meyerhof (1980), Hardy and Townsend (1982), Okamuraet at. (1997), Kenny and Andrawes (1996), Burd and Frydman (1997), and Michalowski and Shi (1995). For footings resting over a two-layer cohesion less soil, the ultimate bearing capacity was studied by Purushothama raj et al. (1974),Satyanarayana and Garg (1980), Florkiewicz (1989), and Azam and Wang (1991).In this study, design charts were developed using the punching shear modeling a dimensionless form since those of Hanna and Meyerhof (1980) were not presented in a non dimension form, which limits their application. The plate load test result were developed for very wide ranges of design parameters. The presented study here may be useful in overcoming the problem of bearing capacity by a significant amount because of the variation of soil profile.

OBJECTIVES

Finding ultimate load carrying capacity of layered soil.

TABLE 1:Experimental work FOR (SAMPLE CLASSIFICATION AND PROPERTIES)

Description	Sample1	Sample 2
Specific gravity (Gs)	2.80	2.58
%G	0	0
%S	25	30
%F	75	70
M.D.D	1.79	1.74
O.M.C	16.5	12
γD Min (gm/ cm3)	-	1.59
γD Max (gm/ cm3	-	1.88
Plastic limit (WP)	18	-
Liquid limit (WL)	36	-
Plasticity index (IP)	18	-
Shrinkage limit(WS)	17	-
Soil classification	CI	SM
Angle of shea resistance	-	34
Shear strength Cu (kg/cm2)	0.47	-

PLATE LOAD TEST (MODEL TEST)

The model plate test for square footing were conducted in a steel tank of size 50cm length×50cm width × 30cm depth. The tank was braced with mild steel sheet all side to avoiding the yielding during loading.

wall of the test tank was rigid and 3 mm thick mild steel sheet . The square footing was made by mild steel plate (bearing plate).

The size of size footing was 10cm×10cm having thickness of 1 cm. The base of the model footing was made rough by cementing a thin layer of sand. Also ends of model footing were made as smooth as possible to reduce the friction during the test.

The layer was prepared by compaction and fix number of blows at the appropriate depth, Over this, sample was compacted up to the desired density and through out height of layer.

A constant vertical load were applied in stages at the centre of the model footing which placed on the prepared soil bed and the centre of the tank.

Load increment through a manual rotation The jack is operated manually As (shown in Fig.1)

The load and the corresponding footing settlement were measured by a proving ring and two dial gauges places on each side of footing. As (shown in fig .2)

MODEL TEST SET UP (FIGURES)
FIG.1

FIG.2

TABLE 2 : MODEL TEST DATA

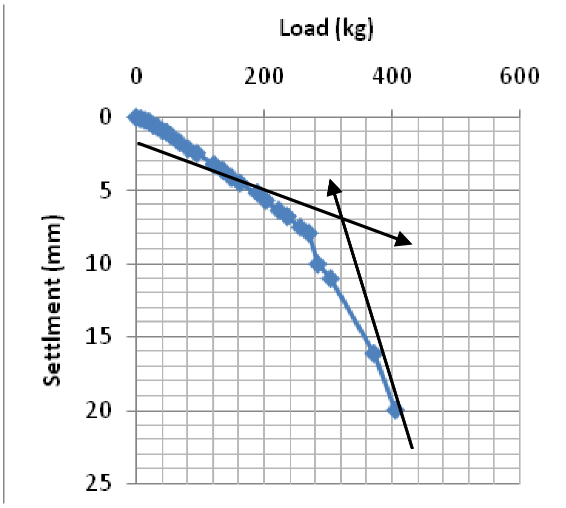
MODEL TEST	
Size of tank	50cm×50cm×30cm
Plate size	10cm×10cm×1cm
Proving ring constant	1.347 kg/div

TABLE 3 : TEST SERIES

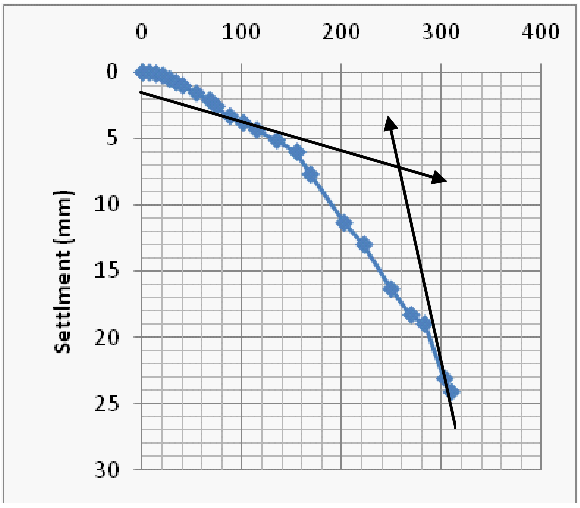
SR NO	SOIL PROFILE	(H1)	(H2)	(B)	(H1/B)
1	Only silty sandy soil	0	30	10	0
2	Top clay bottom silty sand	5	25	10	0.5
3	Top clay bottom silty sand	10	20	10	1
4	Top clay bottom silty sand	15	15	10	1.5
5	Top clay bottom silty sand	20	10	10	2
6	Top clay bottom silty sand	25	5	10	2.5
7	only clay	30	0	10	3

H1 - height of upper layer (CI) soil
H2 - height of lower layer (SM) soil
B - width of footing (CM)

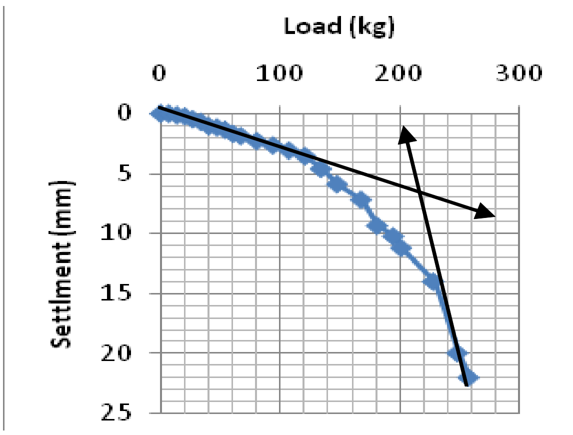
LOAD VS SETTLMENT CURVES



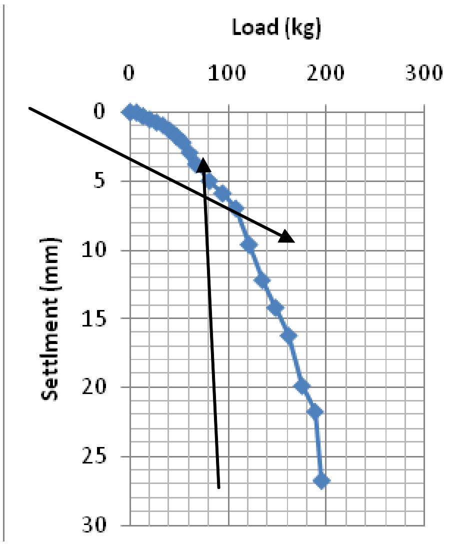
(H1/B) = 0



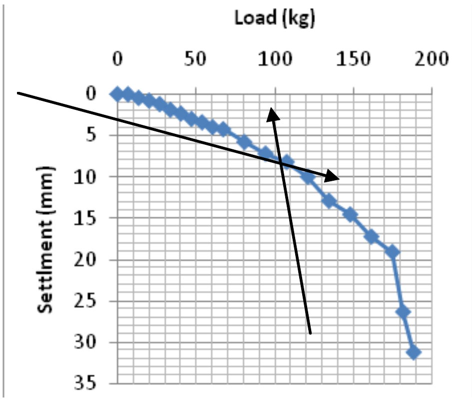
(H1/B) = 0.5



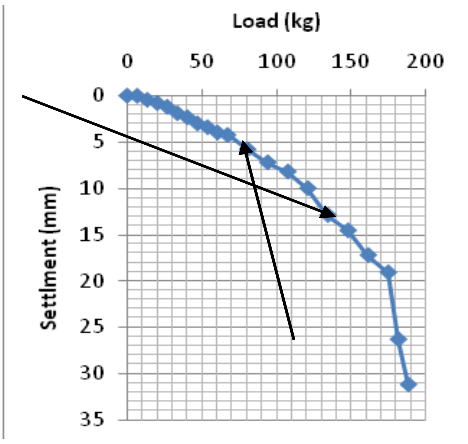
(H1/B) = 1



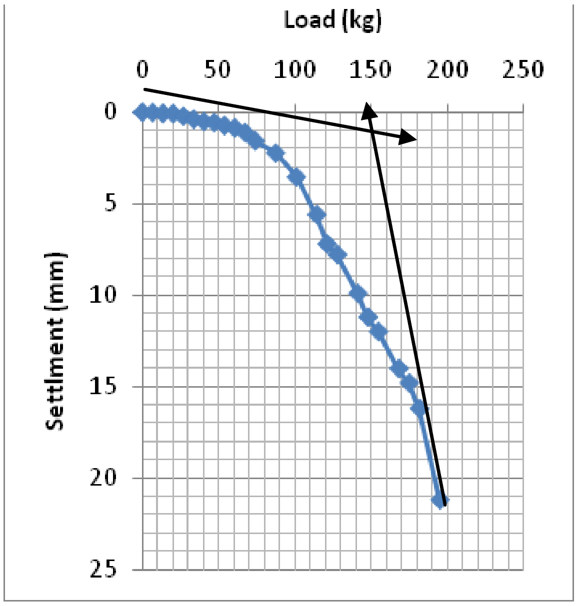
(H1/B) = 1.5



(H1/B) = 2



(H1 / B) = 2.5



(H1/B) = 3

RESULT (Ultimate load by tangents intersection method):

TABLE 4: RESULT

SR NO	H1/B	ULTIMATE LOAD (KGF)
1	0	305
2	0.5	250
3	1.0	208
4	1.5	180
5	2.0	168
6	2.5	160
7	3	148

Conclusion

1) Ultimate load carrying capacity for clay layer only(CI) =148kgf
2) Ultimate load carrying capacity for sillty sand layer only (SM)=305kgf
3) Ultimate load carrying capacity of Layered deposit of clay layer overlying on silty sandy soil decrease with increasing ratio of upper clay layer thickness by width of footing .
4) Observed failure General shear failure and local shear failure.

REFERENCES

Terzaghi, k. " Theoretical soil Mechanics", john wiley and sons, Newyork ,1943 | IS 6403:1981 "Is code for Determination of B.C. of SHALLOW FOUNDATIONS" (FIRST REVESION) ,MEYERHOF, "Methodology for ultimate B.C. for stratified soil system",1963 | MEYERHOF and HANNA , "Ultimate B.C of SHALLOW rough continuous foundation supported by strong layer underlain by weaker soil", MADHAV and SHARMA , "Bearing capacity of soft clay deposits overlain by a stiffer layer",1991,R. Kaczynski and S.J. matysiak, "Modeling of mechanical behaviour of some layered soil.(kwartalnik Geologiczny)",1993 | K.P. jaya ,A. meher prasad, "Embedded foundation in layered soil under dynamic excitations (soil dynamics and earthquake engg.22 485-498)",2002 SHIAU,LYAMIN and SLOAN, "Ultimate capacity of a strip footing resting on a sand layer over clay layer",2003 | IS CODE 1888 method of test load on soil (plate load test),Ultimate bearing capacity test on sand with clay layer By Masanobu Oda1 and Soe Win.