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BEARING CAPACITY TEST OF SOIL AT AMLOH ROAD, MANDI GOBINDGARH-PUNJAB

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ABSTRACT

A foundation is required to transmit the load of the structure on a large area of the soil . To avoid bearing capacity failure of foundation it is essential to take into consideration before design of foundation, two type of action by the soil when subjected to load. This paper focus on the bearing capacity should be low enough to ensure that the settlement caused is not excessive.The bearing capacity should be such that excessive shear strength is not caused.

Key Words: Foundation, Bearing Capacity, Plate, Pressure
Sub Area : Transportation Engineering
Broad Area: Civil Engineering

Important definitions

Foundation: it is the lowest part of structure which support a structure
Bearing capacity: it is the load carrying capacity of soil.

Ultimate bearing capacity (qu): it is the minimum gross pressure at the base of the oundation at which the soil fails in shear

Gross pressure (q): it is the total pressure at the base of fitting due to the weight of the super structure, self weight of the fotting & weight of soil fill.

Net ultimate bearing capacity (qnu): it is the minimum net pressure intensity which cause shear failure of the soil.

Net safe bearing capacity (qns): it is the net ultimate bearing capacity divided by facto of safety .
Allowable Bearing capacity (qa): It is the loading intensity at which neither the soil fails in shear nor there is excessive settlement detrimental to the structure .

Factors affecting Bearing capacity :

1. Types of soil
2. Physical characteristics of foundation
3. Soil Properties
4. Types of Foundation
5. Water Table

Test on soil :

1.Plate load Test: (IS 1888:1982)

Plate load test is a field test to determine the ultimate bearing capacity of soil & probable settlement under a given loading the test essentially consist in loading a rigid plate at the foundation level ,& determining the settlement corresponding to each load increment. The ultimate bearing capacity is the taken as the load at which the plate start sinking at a rapid rate.The method assumes that down to the depth of influence of stresses ,the soil strata reasonably uniform.

Bearing Plate : The bearing plate is either circular or square ,made of mild steel of not less then 25 mm in thickness and varying in size from 300 to 750 mm.

The plate is provided with handles for convenient setting and center marked.As an alternative,cast in situ or precast concrete blocks may be used with depth not less than two thirds the width.Except in case of road problems or circular footings. Square plates may be adopted.For clayey and silty soils and for loose to medium dense sandy soil with N<15, a 450 mm square plate or concrete blocks shall be used.In case of dense sandy of gravely soils (15 < N< 30),three plates of sizes 300 mm to 750 mmshall be used depending upon the practical considerations of reaction loading and maximum grain size.The size of the plate shall be atleast four times the maximum size of the soil particles present at the test location.

Test Pit :

The test pit,usually at the foundation level,having in general normally of width equal to five times the test plate or block,shal have a carefully leveled and cleaned bottom at the foundation level,protected against disturbances of changes in natural formation.The

test pits should preferably have steps to conveniently go in the pit for seating and for taking observation.

Loading arrangement : The loading to the test plate may be applied with the help of test plate may be applied with the help of a hydraulic jack.The reaction of the hydraulic jack may be borne by either of the following two methods :

a) Gravity loading platform method
b) Reaction truss method

a) Gravity loading method :

In the case of gravity loading method,a platform is constructed over a verticalcolumn resting on the test plate,and the loading is done with the help of sand bags,stones or concrete blocks.When load is applied to the plate ,it sinksor settles.The settlement of the plate is measured with the help with the help of sensitive dial gauges.For square plate,two dial gauges are used. The dial gauges are mounted on independently supported datum bar.As the plate settles,the ram of the dial gauge moves down the settlement is recorded.The load is indicated on the load – gauge of the hydraulic jack.

b) Reaction Truss Method :

The truss is held to the ground through soil anchors.Theses anchors are firmly driven in the soil with the help hammers.The reaction truss is usually made of mild steel sections.Guy ropes are used for the laterally stability of the truss.

Indian Standard Code (IS : 1888-1982) recommends that the loading of the plate shoulplateplate d invariably by borne either by gravity loading platform or by the reaction truss.The use of the reaction truss is more popular now-a-days since this is simple ,quick and less clumsy.No support of loading platform should be located within a distance of 3.5 times thesize of the test plate from its center.

Setting of the plate :

The test plate shall be placed over a fine sand layer of maximum thickness 5mm ,so that the center of the plate coincides with the center of the reaction grider/beam,with the help of the plumb and bob and horizontally leveled by a spirit level to avoid eccentric loading.The hydraulic jack should be centrally placed over the plate with the loading column in between the jack and the reaction beam so as to transfer the load to the plate.A ball and socket arrangement shall be inserted to keep the direction of the load vertical throughout the test.

Load increments :

Apply the load to soil in cumulative equal increments upto 1 kg/cm or one fifth of the estimated ultimate bearing capacity,whichever is less.The load is applied without any

impact, fluctuation or eccentricity and,in case of hydraulic jack,load is measured over the pressure gauge,attached to the pumping kit kept over the pit,away from the testing plate,through extending pressure pipes.

Settlemets and Observations :

Settlements should be observed for each increment of load after an interval of 1,2.25,4, 6.25,9,16 and 25 minutes and thereafter at hourly intervals nearest 0.02 mm. In case of clays soils, the time settlements curve shall be increased to next stage either when the curve indicates that the settlements has exceeded 70 to 80 percent of the probable ultimate settlement at that stage or at the end of 24 hour period. For soil other than clays soils,each load increments shall be kept for not less than one hour or upto a time when the rate of settlements get appreciably reduced to value of 0.02 mm/min. The next increment of load shall then be applied and the observation repeated .The test shall be continued till a settlements of 25 mm under the normal circumstances or 50 mm in special cases such as in dense gravel ,gravel and sand mixture is obtained or till failure occurs ,whichever is earlier.Alternatively ,where settlements does not reach 25 mm, the test should be continued to atleast two times the estimated design pressure.If needed ,rebound observation may be taken while releasing the road.

Load settlement curve and ultimate bearing capacity:

A load settlement curve is plotted out to arithmetic scale .From this load settlement curve,zero correction which is given by the intersection of the early line or nearly straight line of the curve with zero load line shall be determined and subtracted from the settlement readings to allow for the perfect seating of the bearing plate and other causes.IS :1888 :1982 has not specified any factor of safety .In order to determine the safe bearing capacity,it would be normally sufficient to use a factor of safety of 2 or 2.5 on the ultimate bearing capacity.

Observation Table

PROCTOR COMPACTION TEST

(A) Soil Sample I

i) Weight of the sample after griding & sieving through 425 µ sieve = 3 Kg
ii) Weight of mould = 4.179 Kg
iii) Light weight compaction in three layers (25 blows for each layer) = 2.6 Kg

a) Density :

S.No	Determination	1	2	3
1	Percentage of Water	12 %	14%	16 %
2	Wt. of mould + compacted soil (g)	6.14	6.256	6.246
3	Wt. of compacted soil (g)	1961	2077	2067
4	Wet density (g/cc)	1.961	2.077	2.067
5	Dry density (g/cc)	1.708	1.759	1.734

b) Water Content

S.No	Determination	1	2	3
1	Percentage of Water	12 %	14 %	16 %
2	Wt. of container	35.0	36.2	30.7
3	Wt.of container + wet soil (g)	47.40	46.00	43.70
4	Wt. of container + dry soil (g)	45.80	44.50	41.60
5	Wt. of water (g)	1.60	1.50	2.10
6	Wt. of dry soil (g)	10.80	8.30	10.90
7	Water content 'ω' (%)	14.81	18.07	19.20

(B) Soil Sample II

i) Weight of the sample after grinding & sieving through 425 μ sieve = 3 Kg
ii) Weight of mould = 4.180 Kg
iii) Light weight compaction in three layers (25 blows for each layer) = 2.6 Kg

a) Density :

S.No	Determination	1	2	3
1	Percentage of Water	12 %	14%	16 %
2	Wt. of mould + compacted soil (g)	6080	6161	6147
3	Wt. of compacted soil (g)	1900	1981	1968
4	Wet density (g/cc)	1.900	1.981	1.968
5	Dry density (g/cc)	1.710	1.758	1.743

b) Water Content

S.No	Determination	1	2	3
1	Percentage of Water	12 %	14 %	16 %
2	Wt. of container	20.20	36.20	30.50
3	Wt.of container + wet soil (g)	39.20	52.20	63.70
4	Wt. of container + dry soil (g)	37.30	50.40	59.90
5	Wt. of water (g)	1.90	1.80	3.80
6	Wt. of dry soil (g)	17.10	14.20	29.40
7	Water content 'ω' (%)	11.11	12.68	12.93

Conclusion:

This paper reveals that the foundation of structure should be so designed that the soil below does not fail in shear nor there is excessive settlement of the structure. The bearing capacity of foundation is the maximum load per unit area which the soil can support without failure. it depends upon the shear strength of soil as well as shape, size, depth and type of foundation. the settlement increases linearly with load at the initial stage, on further increase in load, the settlement increases rapidly and then continue to increase without any appreciable increase in load, this stage is called failure of foundation.

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