Load Settlement Behaviour of Circular footing On Sand-Fly ash Bed

Maya P, Anjana T R

Abstract— Fly ash is produced in large amount as a by –product of thermal power plants every year. For the effective utilization it can be used as filling for low lying area ,construction site, embankment etc. Objective of present work is to study the load settlement behavior of fly ash overlaying sand deposit .Load test is performed on the circular footing resting on sand bed at maximum density. Fly ash be of varying thickness were introduced over the sand bed. Thickness of layer were chosen as 4cm,8cm,12cm,16cm,20cm.Three footing of diameters 100mm,115mm,130mm were used in the model study .As the thickness of fly ash layer increases settlement decreases.

Keywords — Circular Footing, Density, Fly ash ,Model footing, Sand, Settlement, Thermal Power Plants

1 Introduction

THE thermal power stations in India use coal and produce large quantities of fly ash. In India, around 70-75% electricity is generated by coal based thermal power plants. Ash that falls to the bottom of boiler is called bottom ash. In modern coal –fired power plants, fly ash is generally captured by electrostatic precipitators upon the source and composition of the coal being burned, the components of the fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO_2), Aluminum oxide (Al_2O_3) and Calcium oxide (CaO).

Every year nearly 40-50% fly ash remains unutilized in India. Fly ash production in large amount causes several environmental problems. Problems such as land use, Health hazards and environmental dangers. Utmost care should be taken for disposal and utilization of fly ash. Low laying areas can also be used to construct the building .However, in order to enhance the effective utilization of fly ash, low laying areas are raised by providing a fly ash bed at certain thickness over natural soil. Due to different composition, each layer may exhibit difference in terms of bearing capacity, settlement, cohesion, etc.

The present work aims to study the behavior of circular footing resting on fly ash under laid by sand bed at maximum density when subjected to axial load. Number of plate load tests performed to predict the load-settlement behavior.

- *Anjana T R is currently Associate Professor in Civil Engineering at Thejus Engineering College, Vellarakkad , Thrissur, Kerala, India E-mail: anjanatr @gmail.com*
- *Maya P is currently pursuing master's degree program in geotechnical engineering at Thejus Engineering College, Vellarakkad, Thrissur, Kerala, India, PH-7902694352. E-mail: mayapacheery@gmail.com*

2 Materials

2.1 Sand

Sand shown in figure.1 was collected from Pavaratty, Thrissur. The properties of the sand used for the study were determined and listed in Table 1.

Fig.1 Sand

Table 1 Basic Properties of Sand

PROPERTIES	VALUES
Specific Gravity	2.66
Maximum Dry Density(g/cc)	1.68
Cohesion(kN/m^2)	0
Angle of internal friction, Ø(Degrees)	39
Coefficient Of Uniformity	2.6
Coefficient Of Curvature	1.13
Classification	SP

2.2 Fly Ash

For the study, dry and clean fly ah as shown in figure 2 was used and its properties were given in Table 2.The fly ash was collected from Neptune Ready Mix Factory, Mundoor, Thrissur.

Fig.2 Fly ash

Table 2 Basic Properties of Fly ash

PROPERTIES	VALUES
Specific gravity	2.06
Liquid limit (%)	35
Plastic limit	Non- plastic
Maximum dry density(g/cc)	1.28
Optimum moisture content (%)	28
Specific gravity	2.06

3 Experimental Set up and Testing Programme

For the experimental study the following equipment's were used

(a) Tank Size-74.5cmx74.5cmx60cm

(b)Circular footings of 100mm diameter, 115mm diameter, 130mm diameter

(c)Proving Ring of 50kN capacity

(d)Dial Gauges

Plate load test were performed on two conditions (a) sand bed (b) sand bed overlaid by fly ash bed. The test were conducted at different thickness of fly ash such as 4cm,8cm,12cm,16cm and 20cm.Using the maximum density of sand and volume of tank, mass of sand to be filled in the test tank was calculated. The calculated mass of soil was filled in the tank by pouring from a particular height. The height was chosen by trial and error method. After that load tests were performed on the sand bed in the tank using circular footing of three diameters (100mm, 115 mm and 130 mm). Second stages of experimental analysis were performed by introducing fly ash bed at different thickness. Fly ash beds were prepared by replacing the top layer of sand with its corresponding thickness. It should be noted that Fly ash bed was prepared at dry of optimum moisture content.

4 Results and Discussions

Plate load test conducted on (a) sand bed at maximum density (b) sand bed at maximum density overlaid by fly ash bed of varying thickness such 4cm, 8cm, 12cm, 16cm, 20cm.

4.2.1 Sand Bed

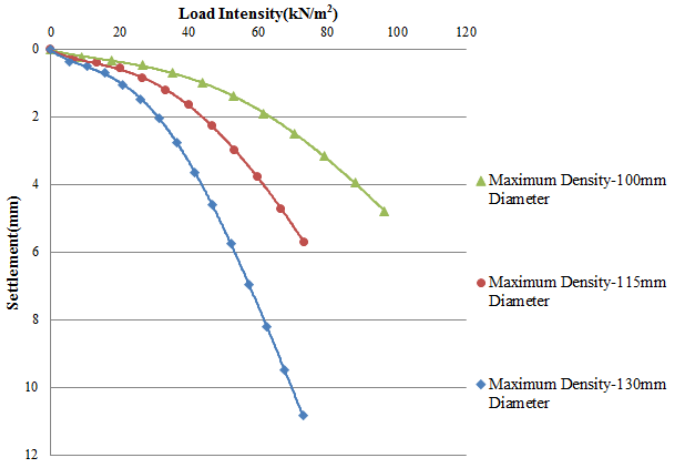

Fig.6 Load Settlement Curve For Three Circular Footings

4.2.2 Sand Bed Overlaid By Flyash Bed

(a)For 100mm Diameter

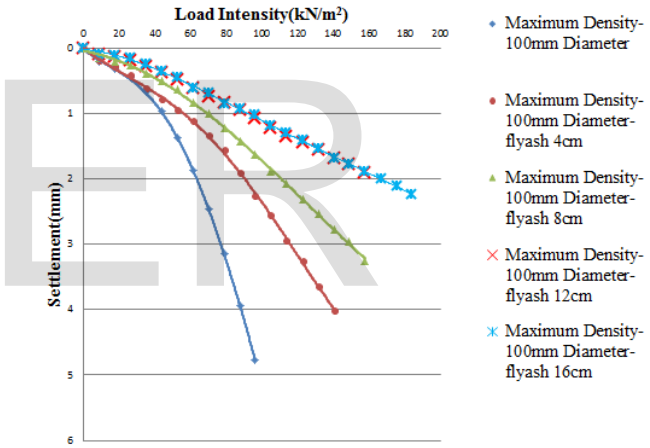

Fig.7 Load Settlement Curve For 100mm Circular Footing

(b)For 115mm Diameter

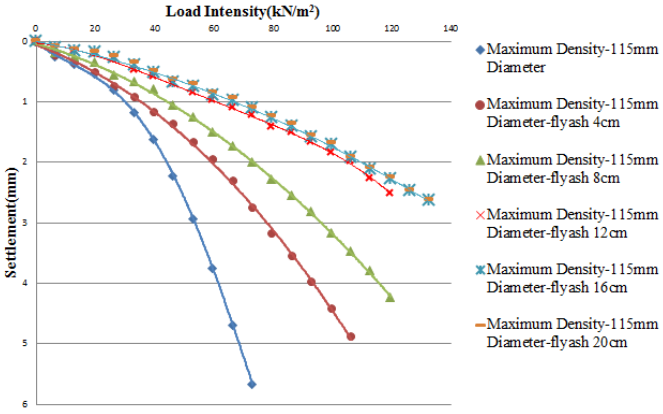

Fig.8 Load Settlement Curve For 115mm Circular Footing

(c)For 130mm Diameter

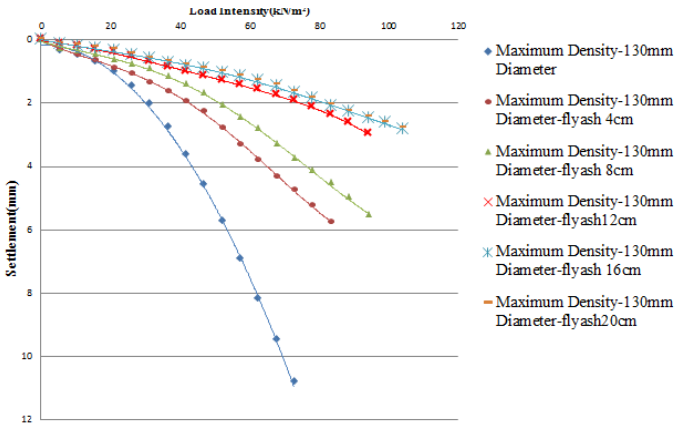

Fig.9 Load Settlement Curve For 130mm Circular Footing

5 Conclusions

- As the diameter of plate increases settlement increases
- As the diameter of footing increases there is considerable reduction in ultimate load improvement.
- As the thickness of fly ash bed increases settlement decreases up to 16cm after that there is no significant reduction in settlement. So 16cm is taken as optimum value in the case of 115mm diameter and 130mm diameter circular footings.

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