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STUDY OF BEARING CAPACITY OF SQUARE FOOTING ON FLYASH SLOPE

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Abstract: Fly ash is the waste material from factories. The disposal of waste material is great problem. In this direction over the past few years many researchers have attempted to convert this waste into useful civil engineering construction material. Hence, the proper utilization of fly ash is major concerned in India. Fly ash can be used as backfill material for low lying area. The aim of present study is to prove that the fly ash can be efficiently use as backfill material. The footing is rest at various position on steep slope of 60^0 and bearing capacity is checked.

Keywords: Fly Ash, Backfill Material, Slope.

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1. INTRODUCTION

In developing country like India, there is tremendous increase in population, tourism and scarcity of plain land, therefore development in hilly and nearby region is important. Construction of foundation on slope is different from the plain ground. Hence, it is necessary to distinguish between the behavior of shallow foundation on slope and on plain ground. There are many situations where foundations need to be located either on the top of a slope or on the surface of slope itself, for examples foundation of a bridge abutment, tower footings for electrical transmission lines, the small to medium rise buildings at slope, shallows foundations are frequently used in hilly regions, etc. When footing is constructed on sloping ground, the bearing capacity of the footing may be reduced depending on location of footing on slope.

Thermal power plant or similar plants in India which use pulverized coal as a fuel, generates million of fly ash every year as a waste. The disposal of waste material is great problem. Fly ash can be used as backfill material for low lying area, construction of backfill material on slope and in retaining structure, foundation basematerial, sub-base material for pavement and construction of earth embankment.

1. LITERATURE REVIEW

Sr. No.	References	EvaluationApproach
1	Kumar and Ilamparuthi(2009)	Bearing Capacity increase with decrease in slope angle and increase in edge distance
2	Dr. Abbas and Sabbar (2011)	Ultimate bearing capacity for rectangular footing adjacent to slope of cohesive soils decreases when slope angle (β)
3	Zhan and Liu(2012)	Bearing capacity factor decrease with increase in slope angle.
4	Anand*et al.* (2014)	Bearing capacity increase with increase in cohesion. Bearing capacity factor increase with increase in angle of internal friction. Bearing capacity factor remain unaffected with change in unit weight of soil.

2. METHODOLOGY

The experimental set up was required for conducting the model test in the laboratory on flyash slopes on soft foundation to check its stability. In this study an attempt had been made for proper utilization of fly ash as fill material in slopes.

3.1 Material Required

- Fly ash

For the model tests, dry and clean fly ash as shown in Fig. 1 was used. The geotechnical and engineering properties of fly ash such as specific gravity, density of flyash, dry density and optimum moisture content were determined by conducting various lab test. The values are given in table1 1

Figure 1: Flyash

Table 1 Properties of Fly ash

Sr.No.	Properties	Value
1	Specific gravity	2.22
2	Max dry density	13.62 kN/m^3
3	Optimum moisture content	25%
4	Cohesion	20 kN/m^2
5	Angle of friction	15^o

3.2 Test Equipment

- Tank

The test tank was made of 4 mm thick mild steel having internal dimension 900 mm X 500 mm in plan and 650 mm high.

Figure 2 Test Tank

- Hammer

The hammer was required for compaction of fly ash.

Weight of Hammer = 12 Kg

Height of fall = 400 mm

Number of blows=198

- Model Footing

The model footing used was made of a rigid steel plate of dimensions,100 mm x 100 mm and 10 mm thick. Footing has a little groove at the center to facilitate the application of load. The footing was provided with the two flanges on two sides of footings to measure the settlement of footing under the action of load with the help of dial gauges.

- Dial Gauges and Magnetic base

The dial guage were used to measure settlement. Least count of dial gauges was 0.01 mm and total run was 25 mm. Two dial gauges were used for the measurement of deformation of the footing.

- Proving Ring

For laboratory plate load test, proving rings of 50 kN Capacity was used. The proving ring is fixed to bottom plunger to transfer load from proving ring to footing

- Screw Jack

The load was applied on the model footing with the help of a 25 Ton capacity screw jack. The screw jack was fixed at the center of horizontal member of reaction frame

- Reaction frame

The reaction frame used for applying loads on the model footing, consisting of a horizontal member and two vertical member made of IS channel section.

Figure 3: Reaction Frame

3.3Preparation of slope

The required quantity of dry fly ash was mixed with a predetermined amount of water corresponding to the optimum moisture content (OMC). The well mixed fly ash was then spread in the tank in layers, which was compacted. Uniform compaction of each layer was achieved.

Figure 4: Compaction While Filling Tank

In order to verify the uniformity of test bed, undisturbed samples were collected from different locations of the test bed in order to determine the in-situ unit weight and the values were found to be almost same (coefficient of variability within 1.5%). The placement dry unit weight/density achieved by this procedure was 90% of the standard proctor density. To ensure uniform moisture distribution throughout the test, compacted fly ash bed was left for 24 h and the top surface was kept covered with wet gunny bags in order to prevent the moisture loss if any.

Figure 5: Complete Filling of Tank

After 24hr the compacted fly ash bed was cut to desired slope with the help of a sharp edged trowel.

Figure 6: Slope after Cutting

3.4 Model test procedure

For the experimental investigation, the model slope stability tests were conducted on fly ash to evaluate the strength and stability of fly ash. After preparation of fly ash slope, the model footing of size 100 mm x 100 mm was placedon the slope. Two dial gauges were then placed on the sides of footing. The load is applied on the footing with the help of screw jack in increments. The load transferred to the footing was measured with the help of proving ring. Footing settlement were measured through two dial gauges. The footing settlement was reported as the average value of the reading taken at two different points. In all the test, load was applied until the failure indicated by crack and deformation of slope. The geometry of test configuration is shown in fig. 7

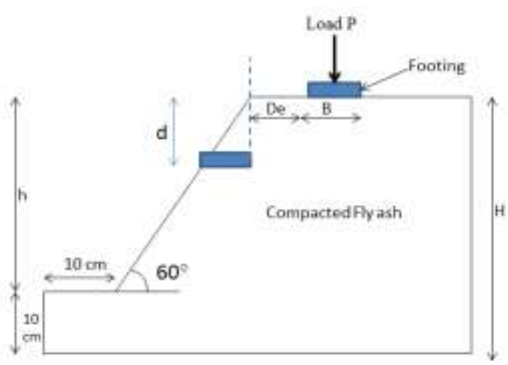

Figure 7: Schematic view of test configuration

Where,

H=Total Height

B=Width of footing

h= Height of Slope

De=Edge Distance

d = depth of footing

P= Load

De/B ratio = Edge distance/ width of footing

d/H ratio = depth of footing / total height

4. RESULT

The test was conducted at various De/B ratio. From which it is observed that at crest i.e.(De/B =0) the bearing capacity is found minimum i.e.250 kN/m2.At De/B=0.5 the bearing capacity was 350kN/m2 and at De/B=1 bearing capacity is found 450 kN/m2. At De/B=1.5 it is found maximum i.e. 500 kN/m2. The result of various De/B ratio are shown in fig.8

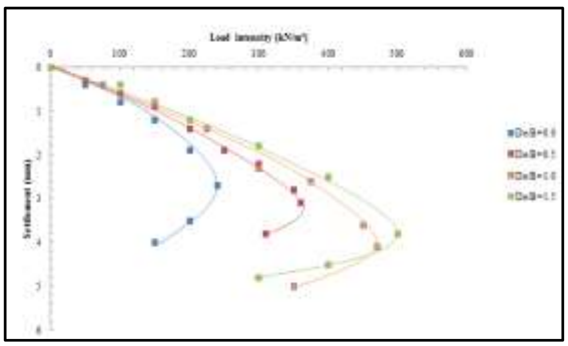

Figure 8: Load versus Settlement graph for different De/B ratio

Similar test where conducted at various d/H ratio on sloping surface. It is found that as d/H ratio increases bearing capacity decreases. The result of various d/H ratio are shown in fig. 9

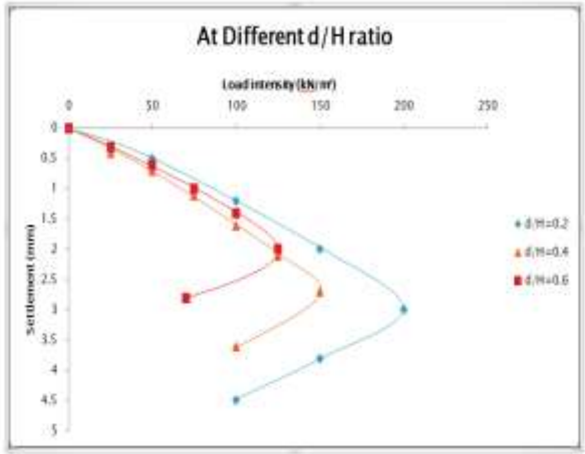

Figure 9: Load versus Settlement graph for different d/H ratio

CONCLUSION

Based on experimental investigation following conclusions can be drawn:

1. Fly ash can be used successfully as backfill material
2. As edge distance increases the bearing capacity increase.
3. On sloping surface bearing capacity is less than top surface of slope.

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