Experimental Study on Load Settlement Behavior of Sand Foundations

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ABSTRACT

In this paper the investigation carried out to study the effect of shape and size of footing on load settlement behavior of sand foundation is presented. To study the effect of shape and size circular, rectangular and square model footings of different area are used. Load is applied through model footings resting on the surface of sand foundation in a model tank. The results have shown that the bearing capacity or the load settlement behavior of foundation soil is dependent on shape and size of the footing. Square footings have shown better load settlement behavior indicating higher load carrying capacity at a given settlement.

1. INTRODUCTION

Load - settlement behavior of supporting soil is an important data useful to assess the bearing capacity which is function of various factors namely shape and size of the base transferring the load to supporting soil, depth of foundation, level of water table, inclination of the load to be transferred etc. Shape and size of the base transferring the load to supporting soil is a key factor on which load settlement behavior depends. In this present investigation an attempt is made to study the effect of shape and size of footing resting at surface of a sand foundation prepared in a model tank made of mild steel sheet, on load - settlement behavior of foundation by loading test.

2. EXPERIMENTAL WORK

To study the effect of shape and size, circular, square and rectangular model footings of different area are used. Loading tests were performed on sand foundation prepared in mild steel model tank, applied through model footings resting on the surface of sand foundation. A loading frame of 2000kN capacity, fabricated indigenously at Padmashree Dr. Vithalrao Vikhe Patil College of Engineering, Ahmednagar was used for loading purpose.

Material Used

Soil
Medium fine sand obtained from Mula river which flows near Ahmednagar city, was used as foundation material in the present investigation. Following parameters of sand are obtained by sieve analysis.

<table>
<thead>
<tr>
<th>Coefficient of curvature</th>
<th>$C_c = 1.352$</th>
</tr>
</thead>
</table>

Coefficient of uniformity  $C_u = 3.67$
Specific gravity  $G = 2.78$

Model Footings

The details of model footing made of 18 mm thick mild steel plates used as model footings are given in table 1.

3. EXPERIMENTAL SET UP

All tests were performed in a rectangular mild steel tank of size 600mm (width) x 750mm (length) x 500mm (depth). The density of foundation soil for the test was maintained as 18.17 kN/m$^3$ for all the loading tests. The loading tests were performed by applying load on model footing resting on the surface of sand foundation. The load applied was measured using a proving ring and settlement was measured using two dial gauges fixed at the opposite corners of the footing. The density of sand was maintained same for all loading tests. The thickness of sand foundation was 450 mm i.e., compacted surface was 50 mm below from top of tank.

Table 1: Details of Model Footings Used

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Footing symbol</th>
<th>Size (mm)</th>
<th>Area $mm^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C-1</td>
<td>120(dia)</td>
<td>11304</td>
</tr>
<tr>
<td></td>
<td>R-1</td>
<td>141.3x80</td>
<td>11304</td>
</tr>
<tr>
<td></td>
<td>S-1</td>
<td>106.3x106.3</td>
<td>11304</td>
</tr>
<tr>
<td>2</td>
<td>C-2</td>
<td>146.9(dia)</td>
<td>16940</td>
</tr>
<tr>
<td></td>
<td>R-2</td>
<td>169x100</td>
<td>16940</td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>130.2x130.2</td>
<td>16940</td>
</tr>
<tr>
<td>3</td>
<td>C-3</td>
<td>171.6(dia)</td>
<td>23115.54</td>
</tr>
<tr>
<td></td>
<td>R-3</td>
<td>188.4x120</td>
<td>23115.54</td>
</tr>
<tr>
<td></td>
<td>S-3</td>
<td>150.3x150.3</td>
<td>23115.54</td>
</tr>
</tbody>
</table>

Note: C = Circular, R = Rectangular and S = Square

(C-3 >C-2> C-1,  S-3 >S-2> S-1 and R-3> R-2>R-1)
4. TEST RESULTS AND DISCUSSION

The load applied is measured using proving ring and corresponding settlement values are obtained from the two dial gauge readings. Load vs. settlement curves are plotted with load on ordinate and settlement on abscissa. Figures 1, 2 and 3 show the load – settlement curves for circular, rectangular and square model footings of different contact area respectively. From these curves it can be observed that for a given shape of footing bearing capacity or load – settlement behavior improves with increase in contact area. This phenomenon is observed in case of all three types of footings. And square footing has shown better load-settlement behavior as compared to circular and rectangular shapes.

5. CONCLUSION

It can be concluded that in case of sand foundation the increase in size of footing will improve the bearing capacity or load – settlement behavior of the supporting soil and also the shape of the footing has influence on the bearing capacity or load-settlement behavior of the supporting soil. Square footing has shown better load-settlement behavior as compared to circular and rectangular shapes.

REFERENCES


