Study on Different Types & Shapes on Footing by using Staad Pro & Effect of Load on Soil

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Abstract— Soil-foundation-structure interaction can affect the seismic response. This work will study the effects of soil-foundation-structure interaction on the seismic response. Four types of foundations with frequency-based design were analysed, including spread foundation, mono pile, pile group with cap, and combined foundation. Soil is modelled both implicitly (subgrade reaction modulus) and explicitly. The finite element method using the Staad Pro program was first validated using experimental data. Recommendations were given to simplify the soil- foundation structure interaction analysis of seismic loading. In this research work we are comparing different shaped footing for same loading condition also soil bearing capacity to determine the best suitable and stale type of footing which can transfer load and also we are preparing cost analysis of all to determine the economical section using analysis tool staad.pro. In this study is can be concluded that Combined footing is comparatively more suitable and best in comparison with Oval or other cases whereas Oval footing is second best and Pad footing is showing worst result. The parameters used for analysis are selected such that they resemble the actual conditions. From the analysis, the method which gives the minimum ultimate bearing capacity for shallow foundation on top of the slope may be recommended for further design.

Key words: Bearing Capacity Factors, Ultimate Bearing Capacity, Slope, Black Cotton Soil, Types of Foundation and Shallow Foundation

I. INTRODUCTION

The lowest a part of a structure that transfers its load to the soil below is understood as foundation. The stability of a structure largely depends on the performance of foundation. Bearing capability and settlement are two parameter demand for the design of shallow foundation. It's essential for engineers to estimate the foundation's bearing capability subjected to vertical masses. Settlement of foundation below load because of the movement of soil particle horizontally and vertically below the footing. Tilt of the footing caused by eccentric loading which ends to non-uniform stress distribution and unequal settlement below the footing. To study the soil interaction ratio using Staad Pro. Analysis of different footing type and shape for same soil bearing capacity. Develop a tool for justifying soil interaction with respect to its bearing capacity. To determine the best suitable footing type and Shape for a considered soil property.

II. LITERATURE REVIEW

To provide a detailed review of the literature related to sloping ground, footing geometry, dynamic analysis and soil properties in its entirety would be difficult to address here. Although there has been a lot of work modeled on sloping ground - none provide in-depth understanding of the seismic response (dynamic analysis) of reinforced concrete (RC) buildings contributions related with soil data and footing geometry also related to tall structures and past efforts most closely related to the needs of the present work. A brief review on footing flexibility and code provision of previous studies is presented here. This literature review focuses on sloping ground, lateral forces in reinforced concrete structures, soil data implementation in a building foundation and some code provisions will be addressed by area.

Algin (2007) the relationship among the flexural formulae and also the vertical and motion equilibrium of forces is related analytically to develop a straightforward and distinctive expression to work out the specified minimum footing space below full compression. This follow of estimating the scale of footing in structural style sometimes employs the traditional reiterative method initiated with the educated guess of designers. The given formula may be a sensible pure mathematics resolution as an alternate to the traditional trial and error methodology for estimating the minimum dimensions of an oblong footing subjected to the mixture of biaxate bending in each axes and vertical column load. The load of footing and also the lateral column hundreds also are enclosed within the formula. It's easy in look and application. It's supported a linearly distributed surface pressure regime that disallows the strain to be developed within the footing/elastic-medium interface. It unifies the assorted formulations common to the sphere of structural engineering.

Dineshh S.Patil and Anil S.Chander (2016) Study a comparative of price of many kinds of foundation as an example, Pad footing, quadrangle footing, Stepped footing. These foundations are accustomed estimate the cost of an optimized style of concrete footing base on structural safety. Foundation is that the interface between the structure building and also the ground. Its task is to transfer safely the building load into the bottom and to stay settlement as tiny as potential. The inspiration system should be styleed to confirm ample external stability of the complete system and maintain the interior load bearing capability of the building elements through acceptable design of the elements. The serviceability of the building should be bonded for its entire lifecycle. equally the cost accounting of the inspiration effects the complete cost accounting of the building that ought to be as economical as potential. The on top of footing, square measure worked for style, material price and optimization

Luévanos and Roja (2016) comparative study for the planning of concrete isolated footings that square measure rectangular or circular in form and subjected to axial load and moments in two directions victimization new models to get the foremost economical footing. The new models take into consideration the important soil pressure working on contact surface of the footing and this pressure is completely different all told the contact space, with a linear variation, this pressure

is bestowed in terms of the axial load, the larger moment around the "X" axis and also the smaller moment around the "Y" axis, wherever the center of mass axes are "X" and "Y" of the footing.

Meyerhof (1974) the study was supported the last word bearing capacity of circular and strip footing resting on sub-soils having 2 layers of various cases of dense sand on soft clay and loose sand on stiff clay. Bearing capability quantitative relation of clay to sand, friction angle, form Associate in Nursingd depth of foundation area unit the most factors that have an influence over sand layer thickness below the footing. For circular footing higher limits of Sg= 0.6 and Sq=1.

III. RESULTS

A. Analysis

In present work in order to compare seismic response of RCC structure in different footing shapes, Response Spectrum Analysis is performed.

- The main difference between the equivalent static analysis and dynamic analysis lies in the magnitude and distribution of lateral forces over the height of the building.
- In the equivalent lateral force procedure the magnitude of forces is based on an estimation of the fundamental period and on distribution of forces, as given by simple formula in IS 1893- 2016.
- The maximum sagging and hogging bending moment, shear force, axial force of each footing type are calculated and tabulated below.

B. Max. Shear Force

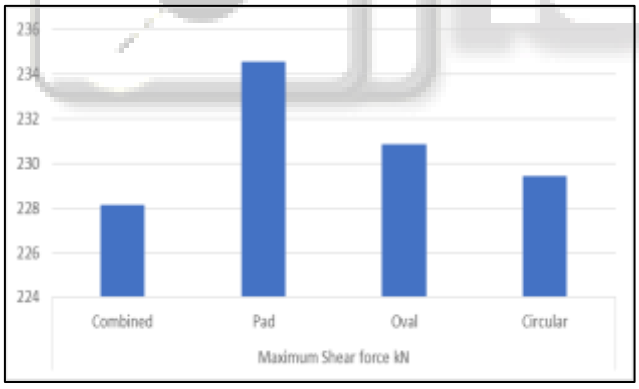

Fig. 1: Shear force kN

C. Max. Axial Force KN

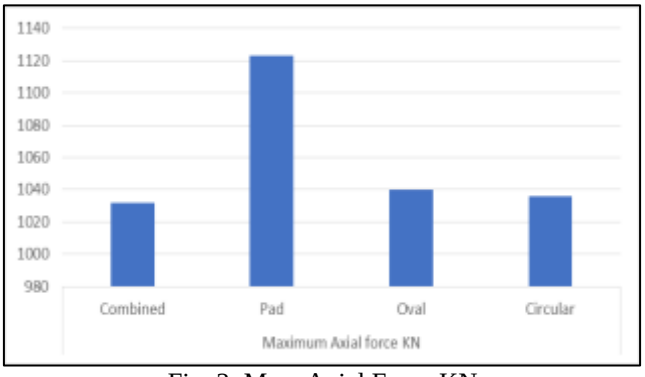

Fig. 2: Max. Axial Force KN

D. Support Reaction

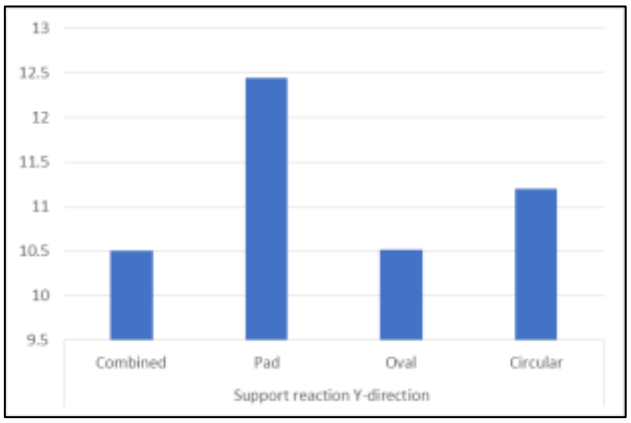

Fig: 3 Support Reaction

E. Max. Deflection (mm)

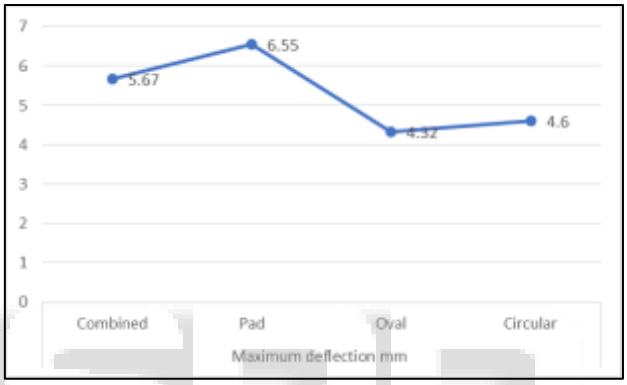

Fig: 6.4 Deflection in Y direction

F. Cost Analysis as per S.O.R.

S. No.	Footing type	Reinforcement (Kg)	Rate of Reinforcement (Kg) as per S.O.R.	Cost of Reinforcement in INR (Rupees)
1	Oval Footing	7953.65	160 / Kg	12,72,584.00
2	Circular Footing	8021.672	160 / Kg	12,83,467.52
3	Combined footing	7651.23	160 / Kg	12,24,196.80
4	Pad Footing	7867.43	160 / Kg	12,58,788.80

Table 1: Cost analysis

IV. CONCLUSION

The dynamic analysis of RCC building shows that dynamic analysis not only gives better understanding of the structural behavior but also following conclusion remarks can be made.

- Combined footing shows 23% less unbalanced forces comparing to Pad shape footing case which makes rectangular footing.
- It is clearly mentioned in the above chapter that Pad shape footing distributes maximum axial force comparatively to other conditions whereas combined footing shows minimum.

- It can be clearly visible that best support reaction is generated in combined footing comparatively to others. As support reaction shows its intensity to distribute load to the soil hence for this distribution combined footing is considered best and suitable.
- The value of deflection is observed maximum in Pad where as in oval shape condition it results in minimum. Thus it can be said that deflection will occur minimum in this condition and second best will be oval one. In oval shape footing deflection is comparatively 13% low.
- As quantity estimation is done and rate is analyzed as per S.O.R it is concluded that Combined footing results in economical type of footing for same conditions whereas circular is costlier and in comparison difficult to build.
- In this study is can be concluded that Combined footing is comparatively more suitable and best in comparison with Oval or other cases whereas Oval footing is second best and Pad footing is showing worst result.

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