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# The Parametric Studies of Factors in Determining the Bearing Capacity of Piles & the General & Differential Amount of Settlements of Piled Raft Foundation

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**Abstract**

In this paper, the behavior of piled raft foundation in contact with layered grain soil, using some modeling and considering the elastoplastic behavior (Mohr-Coulomb model) is analyzed for soils through the Three-dimensional finite element numerical software Plaxis3D Foundation. The purpose of compiling this paper is to parametrically study the effective factors in the behavior of this system in layered soils with the help of numerical analysis and via Plaxis3D foundation software, how they affect on general and differential settlements and the distribution of load among the piles and their share of load bearing in different arrangements considering the amount of the piles tip getting into different thickness of layered soil. Such studies are necessary to access optimized geometrical and mechanical features in design and economy in applying the group of piles and foundation at the same time in contact with soils. The results of these studies can suggest suitable solutions for designer engineers and lead their designs to the best modes.

**Keywords: Piled Raft Foundation, Layered soil, Totality & Differential Settlement, Plaxis3D Foundation, Finite Element Method (FEM).**

## 1. INTRODUCTION

In recent years, the application of Pile Raft foundations has become popular in tall and heavy buildings and also in marine structures. Up to now, wide studies have been done on piles and their integration with shallow foundations, yet there has not been a suitable general estimate of determining their final capacities. This compound system is called the enforced foundation with pile or in short as the ***Piled Raft***.

This structure is an economical choice because when the raft does not satisfy the need for load bearing or settlement, the load bearing capacity increases to a noticeable degree and the general and differential settlements decrease to a high level through whit using several piles under the raft. To have a more general design and analysis with which one can estimate all the required cases; it needs a complete three dimensional analysis. Luckily, today, with the advances made in computers in their speed and processing power and through the application of many numerical methods, it is possible to easily and accurately analyze the pile raft fondation bases in a 3D format. This system includes the three load moving elements (soil, raft and piles) that both the raft and the piles are participants of load moving. This integration of activities between elements has created a complexity in their behaviors. Today, controlling the total and especially differential settlements is of utmost importance in foundations. Since general and differential settlements have a noticeable negative effect on then foundation and the structure based on it, therefore, their amounts should be limited to the amount mentioned in regulations. This system has received attention from different researchers such as Poulos – Lee – Chow– Davis – Randolph – Reul and so on and many studies are done on its mechanism.

In cases where the shallow spread foundations have the ability to bear the load but the degree of settlement passes the limitation, by applying fewer piles compared with the usual deep foundations, general average and differential settlements can be reduced to a noticeable degree [1]. In general, using pile raft in comparison with the group piles decreases the length of piles, improves the servicing of the shallow foundations in general and especially differential settlements minimizing the probability of structure turning and makes the design of the foundation economical. Of course, different factors such as layering soil in depth, interaction between piles, soil and structure, cross section, material, method of Placement, length, relation between length and diameter and distance making and the method of organizing piles under the surface of the raft foundation and how they perform is of the variables that, considering the conditions and the needs of the project, play an important role in optimizing the positive effects of the system and are