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## ABSTRACT

Machine foundations are unique, because they may be subjected to significant dynamic loads during operation in addition to normal design loads of gravity, wind, and earthquake. The magnitude and characteristics of the operating loads depend on the type, size, speed, and layout of the machine. The foundation has to guarantee smooth running during normal operation, and foundation integrity for possible accidental loading situations. Dynamic effects of the machines play a major role on sizing of the foundation where conditions, like resonance is avoided by varying the stiffness and the mass of the structure which leads to modifications in foundation sizes. For carrying out these studies, a detailed 3D finite element analysis approach is considered.

Herein, a finite element software (ANSYS.11) is adopted which provides an efficient tool for dynamic analysis and structural design of machine foundations. First, the analysis is carried out on previously solved problem to verify the capabilities of the program in simulating the machine foundation problem.

As a case study, piled machine foundation in sandy soil is analyzed. Machine foundations resting on end bearing and floating piles are introduced. Harmonic dynamic load is chosen. A parametric study is carried out to investigate the effect of several parameters including: geometry of the piled machine foundation, the amplitude of the dynamic load, frequency of the dynamic load and damping ratio. Linear elastic model is adopted for modeling the piles and their cap for machine

foundation using eight node isoparametric (solid 65) element, while elastic model is adopted to model the soil behavior and eight node isoparametric elements are used to model the soil through (solid 45) element.

It is concluded that as the pile cap thickness increases, the oscillation of displacement decreases due to material damping inherent in the concrete of the cap. There is a limit of pile cap size at which its stiffness governs its dynamic response, above this size, the weight of the cap overrides its stiffness effect, and the additional weight by cap leads to increase the pile foundation displacement. When the pile diameter of the group increases, the frequency, at which the maximum displacement occurs increases hence the system becomes more stable against resonance condition. In the case of changing spacing between piles, the maximum moment factor ( $I_M$ ) is always at the pile cap center where the load is applied. This factor increases when the pile spacing increases. The dimensionless displacement factor ( $I_Z$ ) decreases markedly as the pile cap length increases, reflecting the increase in displacement with pile cap length. The increase of the normalized moment ( $I_M$ ) with pile cap length can be attributed to the increase of the unsupported length within the cap which leads to increase in the moment. The increase in size of pile cap for machine foundation increases the geometrical damping of the structure, and the increase in spacing between piles causes an increase in geometrical damping.

**Keywords:** Pile machine foundation. Dynamic analysis. Machine Foundations