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Vertical Vibration of a Foundation on Elastic Soil Based on In-situ Tests and Experimental Results

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Abstract

There are several approaches to evaluate the vibration of a single foundation under dynamic loading, for example those loads caused from the operation of a vertical vibrating machine. In this paper, some new formulas are presented using the field results and experimental outputs which have been reported by various researchers who assessed the value of soil stiffness in terms of other properties. For this aim, an investigate has been carried out to found a correlation between these features of soil and the vibration parameter of a rigid foundation resting on the ground surface. This parameter includes the vertical amplitude of a foundation displacement and it can be solved analytically, provided that the shear strain level due to dynamic loads is low and less than threshold strain, i.e. 0.001%. Through this condition, the value of a soil stiffness is equal to the maximum shear modulus ($G = G_{max}$) and it is possible to consider the soil as an elastic medium. Hence, it allows to develop new formulas by applying the results of field explorations and experimental low-strain tests to the vibration theory proposed by some authors. This is the novelty of current paper. The obtained formulas indicate that there is a good agreement between the analytical outputs and those being associated with the experimental results as well as in-situ observations. Thus, they can be used to calculate the vertical vibration amplitude of a single foundation that is located on a homogeneous elastic soil.

Key words: Vertical vibration, Foundation, Soil stiffness, Elastic Soil, In-situ Tests, Experimental results

1. Introduction

Reasonable design of foundations for vibrating issues is generally based on displacement considerations. Displacement due to vibratory loading can be classified under two dominant parts: *(i)* cyclic displacement because of the elastic response of the soil-foundation system to the vibrating loading, and *(ii)* permanent displacement resulted from the compaction of soil below the footing. In order to estimate the displacement due to the first loading condition listed above, it is essential to know the nature of the dynamic forces