ABSTRACT

This study deals with the analysis of the vertical response of raft foundations subjected to dynamic loads. The raft is assumed to be supported on Winkler media. Finite element method with eight-noded isoparametric plate bending elements has been used for the analysis. This type of element can be used for the analysis of both thick and thin plates. So this element presents an advantage over the other plate bending elements as it can take into account the shear deformation of the plate.

The concept of modulus of subgrade reaction has been used to represent the soil as a Winkler medium. Different types of foundation soils, viz. sand, soft clay and peat have been considered. For clay and peat, modulus of subgrade reaction has been determined by using the results of triaxial, consolidation, CBR and unconfined compression tests while for sand, it has been determined by direct plate load test in the laboratory.

The dynamic equilibrium equation has been solved by Newmark integration method. In this method the dynamic equilibrium equation is converted into equivalent static equation so that normal static solution procedure can be applied. Gaussion elimination method has been used to solve the set of equations. Step by step variation has been made for size, aspect ratio and thickness of the rafts.

By solving the dynamic equilibrium equation displacements at the nodes of the mesh have been calculated. These values of displacements have been used to calculate moments and shears at the nodes. Finite difference method has been adopted for this

purpose.

Computer programmes have been developed for analyzing the dynamic response of rectangular and circular rafts. The programmes consider two loading cases - uniform load throughout the raft (self weight) and a concentrated load (1000 kN) applied at different nodes for different cases. The programmes can be suitably modified to cater for the raft of any shape under different loading conditions.

The dynamic response of aluminium plates (model rafts) has been experimentally investigated for comparative study of experimental and analytical results. Tests have been carried out for rectangular and circular model rafts of various sizes under vertical vibrations for a wide range of frequencies. From the experiments the resonant frequencies and the resonant amplitudes at different modes have been determined. These values have been compared with the theoretical results obtained by computer analyses on model raft of same shape and size. It has been found that the agreement is fairly well when compared qualitatively but the numerical values (i.e. quantitative results) differ to some extent.

KEY WORDS : Raft foundation, Dynamic response, Machine foundation, Soil foundation interaction, Elastic medium, Idealized soil model, Winkler medium, Modulus of subgrade reaction, Finite element method, Finite difference method, Equilibrium equation, Stiffness matrix, Mass matrix, Load vector, Displacement vector, Poisson's ratio, Mass density, Bending moment, Twisting moment, Shear force.