GROUND BEHAVIORS FROM NUMERICAL CALCULATIONS AND DYNAMIC TESTS

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SYNOPSIS

Coefficient of subgrade reaction, damping constant, settlement, and bearing capacity of shallow foundation on the cohesive soil ground were considered by FEM analysis which is based on investigation of soil behaviors under dynamic tests. It is shown that many apparent behaviors of ground are under the great influence of the growth pattern of plastic zone which depends on the mechanical characters of soil.

SOIL BEHAVIORS, ANALYSIS METHOD, AND RESULTS

Cohesive soil behaviors under dynamic load[1] are summarized as follows; the modulus of elasticity is expressed by the empirical equation in terms of strain amplitude and static strength in Mohr-Coulomb's criterion; Poisson's ratio is the proper value which is same with the static one, and varies to 0.5 only by yield and failure; strength is expressed in the three empirical values which are the terms of magnitude and loading time, on the base of Wöhler curve and Miner's law. On the each step of FEM calculation, the mechanical characters (modlus of elasticity, Poisson's ratio, and strength) of each element are renewed by the loading conditions (static or dynamic, elastic or plastic, confining pressure value, and strain ratio), faithfully to the above experimental results. The ground was supposed to have a balk density, cohesion, angle of internal friction (ϕ), initial Poisson's ratio (μ), and sensitivity ratio.

Partial failure starts before the load of ultimate bearing value, statically. In the case of soft soils (about $\phi \leq 30°$ when μ=0.25, $\phi \leq 25°$ when μ=0.35, $\phi \leq 10°$ when μ=0.48), partial failure starts even under one third of ultimate bearing value load. Change in coeficient subgrade reaction and damping ratio in accordance with the strain ratio, and failure pattern are produced by the growth pattern of the plastic zone which coincides with the stress distribution depending on the soil mechanical characters (angle of internal friction, Poisson's ratio, and sensitivity ratio), and the loading conditions (magnitude, time length and eccentricity). Each computed value agrees well with the measured one, except the dynamic bearing capacity which has never been measured or defined yet. However, it is useful and reasonable to suggest that the safety factor under a certain seismic load is the equivalent value under the static load which gives equal plastic range to that of seismic one. On the same loading conditions, ground compliances are related linearly or hyperbolically with the static bearing capacities.

CONCLUSION

By the above method, ground behaviors could be estimated realistically. Though rough standard values of ground compliances will be offered for the trivial constructions, for the particular ones every values should be calculated severally, because they depends on the particularity of stress consentration. Especially on soft soils, if damping is converted only to the damping constant neglecting the plastic deformation, serious disaster shall be invited.

I would record here my ackonowlegements to Prof. Enami for the permission to reserch.

REFERENCE

1) Enami, Ohhashi; Some dynamic behaviors of undisturbed cohesive soils from laboratry tests, 5WCEE,1973