STUDIES ON PRACTICAL IDEALIZATION OF SOIL-PILE-GROUP SYSTEM CONCERNING DYNAMIC INTERACTION

by

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SYNOPSIS

Experimental surveys and theoretical simulation studies were conducted concerning dynamic interaction problems of soil-pile-group system. This paper shows the abstracts of the studies, points out some characteristic effects of the interaction, and discusses their idealizations for practical lumped-mass model.

EXPERIMENTAL SURVEYS

Typical two pile foundations of actual bridge piers, one of which was in soft ground and the other was in stiff ground, were concerned. The interaction of soil-pile-group foundation was tested through harmonic excitation and artificial explosion earthquake.

Laboratory model tests were also conducted. Soil layer model was made of soft and elastic polymer gel. Pile-group and pier were made of stiff rubber and set in the layer. Reduced scales of them were 1/100 in length and 1/2 in period. Two methods of excitation were taken. In one case, exciting force acted directly on the pier, in another case, the force acted to the base of the layer from a vibration table.

THEORETICAL SIMULATION STUDIES

The procedures of analysis were to simulate the experimental results theoretically and to survey the interaction effects. Models used in this study were as follows;

1) The soil layer was idealized with three dimensional finite element.
2) Pier and pile-group were also idealized with lumped mass-spring system and connected to the finite element layer.
3) Viscous dampers were placed along the side and bottom boundaries of the layer.

CONCLUDING REMARKS

1) When exciting force acts uniformly from the base layer, soil layer resonance predominates.
2) When the force acts directly on the pier, interaction resonance occurres at a higher frequency than that of the layer.
3) Practical lumped-mass model should contain properly damped resonator mass to idealize the interaction resonance of the layer.
4) Group effect of piles and their interaction springs are estimated using the Mindlin's second solution.

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