SEISMIC EVALUATION OF GROUP PILE FOUNDATION WITH M1 AND M2 MODEL

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1. INTRODUCTION

In this paper, a series of numerical analyses using dynamic finite element method on simplified model and full model are conducted to investigate the seismic behaviors of group-pile foundation. In the analyses, a beam theory proposed for RC material, in which the axial-force dependency in the nonlinear moment-curvature relation can be considered properly, is used. Two kinds of models for a ground-pile foundation-superstructure system are used. One is called as simplified model, in which, the interaction between piles and ground is represented by springs and the ground-pile foundation-superstructure system is simplified to a frame-spring model (M1 model). Another model is call as full model, in which, the system is modeled with three-dimensional finite elements without simplification (M2 model). The purpose of the research is to verify the applicability of the dynamic analysis with M1 model that can be commonly used in daily seismic design without much difficult. The analyses with M1 and M2 models on a highway bridge with a 9-pile foundation are conducted to check the accuracy of the analysis with simplified model.

2. SEISMIC RESPONSES OF GROUND-PILE FOUNDATION USING M1 AND M2 MODELS

Under elastic condition, the seismic behavior of free ground from M1 and M2 models are totally the same. Therefore, the simplification involved in M1 model is completely acceptable in seismic evaluation of free ground under elastic condition.

Under elasto-plastic condition, however, there is big difference between the analyses using M1 and M2 models.

The accelerations at the top and bottom of column evaluated with M1 model are much larger than that of M2 model while the accelerations evaluated with M1 model is much smaller than that of M2 model.

The bending moment from M2 model is, on the whole, much larger than that from M1 model. The distribution of the bending moment from M2 model changed its direction along the depth, while the results from M1 models did not change along the depth. These differences are found to be caused by the difference of the deformation of the ground evaluated by different models. The seismic evaluation using M1 model has the risk of underestimation of sectional forces due to earthquake vibration. Therefore, further research should be made to improve the modeling of M1 model in its application.

3. CONCLUSIONS

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