



Similitude Characteristics Between Small-Scale Model and Full-Scale Piles under Dynamic Excitations

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Abstract

In this study, it is intended to use a flexural rigidity-based scaling law proposed by Wood (2004) to predict the dynamic frequency-amplitude responses of the full-scale piles from small scale model pile responses. To obtain this objective, axial harmonic tests on hollow steel single and 2×2 pile group having a diameter of 0.114 m and pile length of 3 m are performed in the field for different magnitudes of dynamic forces (0.868 and 1.944 Nm). The frequency versus amplitude responses obtained from the test show a single peak at resonance within the range of the dynamic test (0-50 Hz) for both types of pile foundation. The responses also exhibit nonlinear characteristics by virtue of reducing the resonant frequency with the increase of dynamic forces. The single pile responses also indicate lower resonant frequency and higher amplitude values as compared to the pile group responses. Using these experimental responses, the responses of the full-scale piles are calculated by assuming the scaling factors of 6, 8, and 10 to consider the full-scale pile lengths of 18 m, 24 m, and 30 m respectively, without changing the aspect ratio of the piles. It is found from the full-scale pile responses that the resonant frequency values are decreased about 4 to 6 times and the resonant amplitudes are increased about 15 to 32 times as compared to the small-scale piles. However, the basic characteristics of soil-pile responses of the small-scale model and full-scale piles are observed to be similar for both the single pile and 2×2 -pile group.

Keywords: Model pile, Axial harmonic tests, Full-scale pile, Dynamic responses, Scaling law