Behaviour of Batter Piles Under Machine Induced Vibrations

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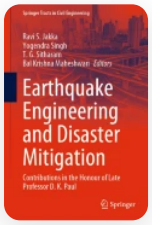

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Abstract

The batter piles have several applications in infrastructure projects, such as offshore structures, transmission towers, bridges, and high-speed turbines involving machine-induced vibrations. This paper presents the details of a series of dynamic lateral and vertical loading tests as conducted on a vertical pile, B0 ($\beta = 0^o$) and batter (i.e., inclined) piles, B10 ($\beta = 10^o$) and B20 ($\beta = 20^o$) constructed in layered silty sandy soil, where β is the inclination of the pile to the vertical. All the piles had a length of 2.5 m and a diameter of 0.20 m. These piles were subjected to six force levels in lateral (X and Z) and vertical (Y)

directions. Accelerometers were placed on the pile cap to obtain the dynamic response of these piles. The results show that the resonant frequency of the soil-pile system decreases by 37–50% along the lateral direction and 43–50% along the vertical direction, with increasing force level. When the force level is increased, the maximum peak displacements in the X and Z directions increase by 11 and 4 times in the case of B0 and B20 piles, respectively. However, the peak displacement increases by 4–5 times in the Y direction with an increase in force level. The increase in lateral strains (in X and Z) in the piles with force level was more prominent in the case of B20 compared to B0 and B10. Further, the increase in axial strain (in Y) with force level was almost four times in all three piles. In both lateral directions, the rotational stiffness of the soil-pile system decreases nonlinearly, whereas the damping ratio increases nonlinearly with an increase in lateral strain.

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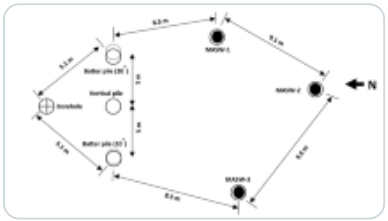

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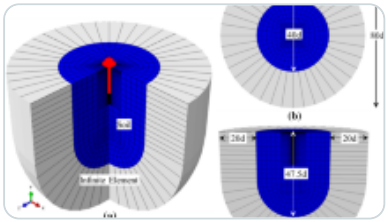

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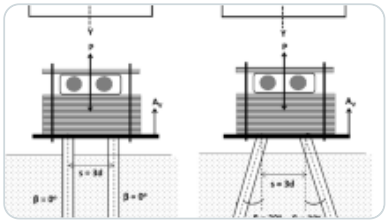

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