

## **Evaluation of Pile Group Efficiency in Pile Foundations without Footing Beams**

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When designing pile foundations against lateral forces, pile group efficiency is considered when evaluating lateral subgrade reaction. Pile group efficiency is generally assessed under the assumption that footing beams or footings are used. However, in some cases, such as pile foundations for over-tracks buildings, neither footing beams nor footings are used. Therefore, this study investigates the influence of footing beams on pile group efficiency through centrifuge model tests and 3D elasto-plastic finite element analysis. The results indicate that the absence of footing beams enhances the pile group efficiency. The mechanism is elucidated by examining the pile deformation modes and the stress distribution in the surrounding soil.