

# Numerical push-over analysis of a bridge piled foundation: geotechnical and structural verification

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## *Summary*

Most of the infrastructures in Europe are approaching their design life and, therefore, their safety under present conditions has to be reassessed. This is particularly crucial in the Italian context, since the current seismic design standards have significantly changed, being more severe than the previous ones. The goal of this paper is the critical evaluation of three different pseudo-static approaches for verifying at Ultimate Limit State a piled foundation of an existing bridge: (i) the standard one, neglecting the raft contribution and assuming foundation failure to be coincident with the failure of the most loaded pile, (ii) an analytical method, neglecting the raft contribution, but considering the ductile redistribution of forces on piles, (iii) a Finite Element numerical analysis, providing a push-over curve for the foundation system and considering both the raft-piles-soil coupling and the structural response of piles.

The results deriving from the first two approaches suggest the necessity of retrofitting measures for the case considered. In contrast, the more sophisticated numerical approach, providing a significant insight in the mechanical response of the system, puts in evidence that, under its current conditions, the foundation does not necessitate neither geotechnical nor structural retrofitting measures. More generally, this paper shows that considering the raft presence may allow a more rational and sustainable design of piled foundations.