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Evaluation of the efficiency of soft-soil improvement with rigid inclusion.

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Settlement of an improved compressible soil loaded by an embankment is a common geotechnical problem. Often, excessive settlements influence the feasibility of embankments on compressible soils, limiting the functionality of the infrastructure.
Soil improvement can be implemented using different techniques; one of which is to install high stiffness columns compared to the surrounding soil matrix.
The problem of the load distribution is three-dimensional. Simplified approaches often use a homogenization technique. These techniques provide a first approximation about the behavior of the composite system. However, simplified analyses have some uncertainties related to the mechanical characteristics of the improved soil.
This paper summarizes the measurements and the back analyses of the settlements for a 6-to-10m-high embankment resting on soft soil. Different inclusion lengths have been chosen along the embankment alignment: “fully” improved, “partially” improved and no improvement. In the case of "fully" improved subsoil, the inclusion run through the entire compressible layer while for "partially" improved subsoil, a shorter length was adopted.
Screw-drilled columns were used as the improvement technique. The columns provide an additional benefit by increasing the mesh lateral stiffness due to the partial lateral soil spreading during the drilling phase. After the drilling phase is complete, the screw is withdrawn while placing the concrete. The excavation is self-supported by the screw and it is not necessary to use any slurry.
The measured settlements were strictly related to the presence and length of the inclusions. The critical analysis of the experimental data, with the help of 3D numerical analyses, has enabled the development of an efficiency factor and the calibration of the simplified design approach.