SOIL REINFORCEMENT OF TRANSPORTATION INFRASTRUCTURE: CUSTOMIZED 3D-PRINTED GEOGRID FOR CENTRIFUGE SHAKE TABLE TESTING

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Rocking footings in shallow foundations can reliably recenter themselves while dissipating energy during earthquake events. However, the foundations are prone to excessive settlement and residual rotation. This study focuses on using ground improvement strategies during centrifuge modeling to preserve the beneficial traits of rocking footings while counteracting the foundation's settlement and rotation. In civil engineering applications, geogrids are used to reinforce the soil which increases the bearing capacity and strength of the soil. Placing geogrids below the rocking footing has the potential of controlling the kinematics of rocking footings without changing its physical properties. An ideal ground improvement configuration was identified to have minimal settlement and maximum energy dissipation and re-centering. A baseline case was first developed for a rocking footing without ground improvement by subjecting it to shaking at a level that caused it to settle excessively. To represent a stiffer geogrid the design was printed using PLA (polypropylene) and TPU (Thermoplastic polyurethane) for a flexible geogrid. During and after earthquake shaking the rocking footing that was reinforced with the PLA geogrid had the least amount of settlement. By designing 3d printed geogrids for centrifuge testing, you can systematically replicate full size seismic events using relatively small scales and accurately assess the performance of rocking footings and its relation to various types of geogrids. Further implementation of ground improvement strategies on shallow foundations reduces risk of infrastructure failures in the event of severe earthquakes.