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Investigation of Contact Pressure Distribution at Expanded Polystyrene Geofoam Interfaces Using Tactile Sensors

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Abstract : EPS (Expanded Polystyrene) geofoam as light-weight material in geotechnical applications are made of pre-expanded resin beads that form fused cellular micro-structures. The strength and deformation properties of geofoam blocks are determined by unconfined compression of small test samples between rigid loading plates. Applied loads are presumed to be supported uniformly over the entire mating end areas. Predictions of field performance on the basis of such laboratory tests widely over-estimate actual post-construction settlements and exaggerate predictions of long-term creep deformations. This investigation examined the development of contact pressures at a large number of discrete points at low and large strain levels for different densities of geofoam. Development of pressure patterns for fine and coarse interface material textures as well as for molding skin and hot wire cut geofoam surfaces were examined. The lab testing showed that I-Scan tactile sensors are useful for detailed observation of contact pressures at a large number of discrete points simultaneously. At low strain level (1%), the lower density EPS block presents low variations in localized stress distribution compared to higher density EPS. At high strain level (10%), the dense geofoam reached the sensor cut-off limit. The imprint and pressure patterns for different interface textures can be distinguished with tactile sensing. The pressure sensing system can be used in many fields with real-time pressure detection. The research findings provide a better understanding of EPS geofoam behavior for improvement of design methods and performance prediction of critical infrastructures, which will be anticipated to guide future improvements in design and rapid construction of critical transportation infrastructures with geofoam in geotechnical applications.

Keywords : geofoam, pressure distribution, tactile pressure sensors, interface
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