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Earth load reduction induced by expanded polystyrene (EPS) geofoam applications for deeply buried arch structures

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The objective of this study was to evaluate the load reduction effects on deeply buried arch structures surrounded by Expanded Polystyrene (EPS) geofoams. The soft lightweight compressible materials such as EPS, straw, compressible soil, or leaves have traditionally been used to reduce the earth pressures on the buried pipes or culverts. The relative settlement of these materials generates the upward shearing forces to support soil prism above the buried structure, which results in the reduction of earth loads on the structure. It has been found that the application of EPS geofoams surrounding buried structures is much more effective to reduce earth pressures than the installation of them on the top of the structure. This concept, however, has not been applied to buried arch structures yet. The nonlinear soil models were adopted to simulate complex soil behaviors. The finite element (FE) models for soil-arch systems associated with EPS geofoams have been developed to evaluate the structural behaviors of buried arch structures. This study revealed that the EPS geofoam application to buried arch structures is highly effective to reduce the earth loads on the structure, and consequently to enhance the safety margin of buried arch structures.

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