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Product Information Bulletin

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GeoSpec® Lightweight Fill Material for Load Reduction on Buried Utilities

Modern highway construction and development sometimes may require construction of high embankments where the fill height above the top of buried rigid and flexible utilities may be greater than 10 m (32.8 ft). The high embankment fills may impose significant earth loads on the underground structures.

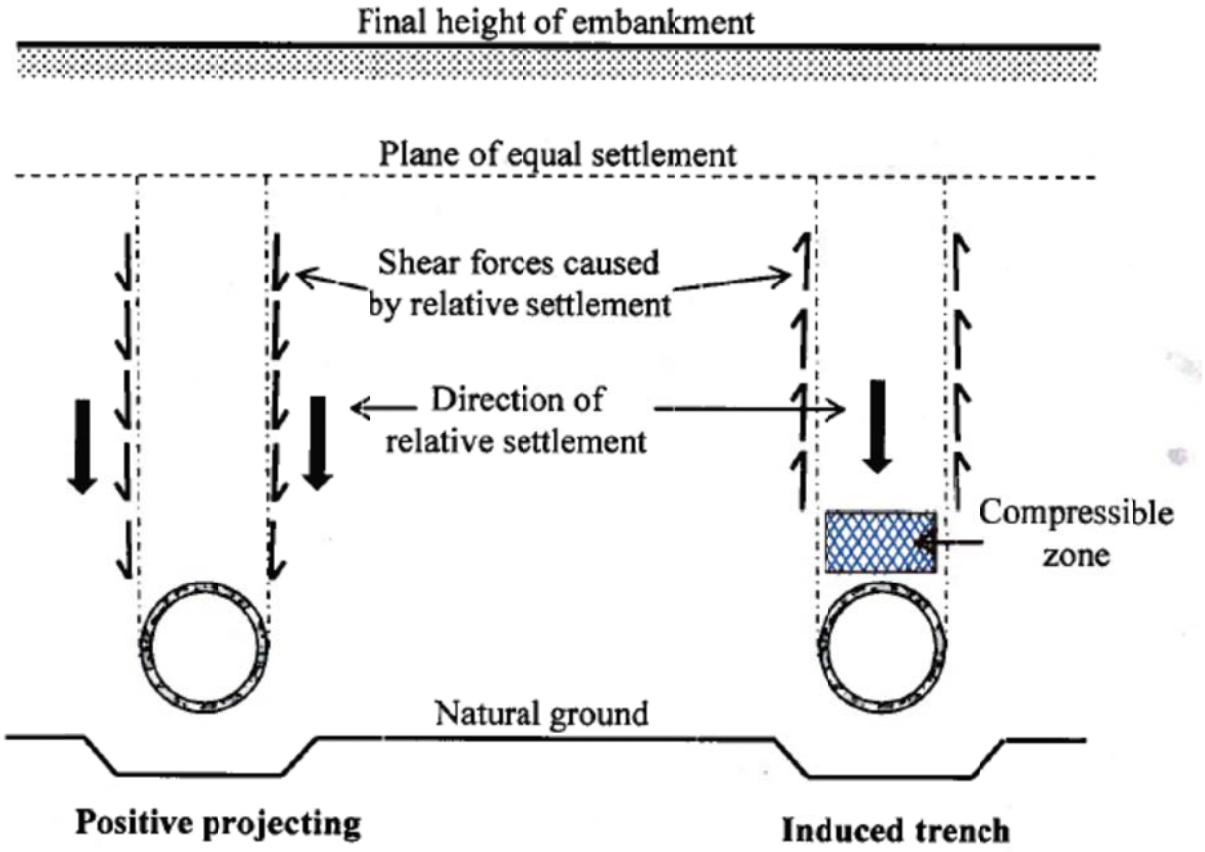
This bulletin will discuss the use of GeoSpec lightweight fill material as a compressible material above deeply buried utility lines. Compressive loads on buried utility lines have been shown to be dependent upon installation conditions.

Pipe installations are called trench installations when the pipe is located completely below the natural ground surface. Frictional forces between the sides of the trench and the backfill material help to support the weight of the soil overlaying the pipe. Pipe installations are called embankment installation when soil is placed in layers above the natural ground. The vertical earth pressure on a rigid pipe installed using embankment construction method is generally greater than the weight of the soil above the structure because of negative arching.

When high embankment fills are required over rigid culverts, the installation methods typically used are positive projection installation or induced trench installation. The induced trench installation method introduces a zone of compressible material such as EPS geofoam above the culvert.

The concept behind this method is to reduce the vertical earth pressure on the utility by inclusion of a lower density fill material (compressible layer), thus reducing the load over the utility, but also inducing positive arching. The compressible material above the utility line causes differential settling of the column of soil directly above the utility relative to the adjacent soil. The earth load from the column of soil directly above the culvert is partially supported by the shear forces developed on the soil interface with adjacent soil columns, thereby resulting in some of the load being redistributed to the adjacent fill.

To reduce the vertical earth pressure on rigid pipes (Figure 1), the imperfect ditch method has been introduced. Research has been conducted in the past few years to examine the benefits of induced trenching achieved by embedding a layer of compressible EPS geofoam material above buried conduits resulting in economic design. Results indicated that EPS geofoam behaves as an ideal elastic-plastic compressible material for use in the imperfect trench method.



The reduced load on buried utilities using induced trench installation method and EPS geofoam has been demonstrated in research conducted using both laboratory simulations[1] and through ongoing monitoring of utility line installations.

Other Reference Documents:

1. Valstad, J., Sayd, M.S., Johansen, T.H. and Wiman, L., Load reduction and arching on buried rigid culverts using EPS Geofoam - Design methods and instrumented field tests, 4th International Conference on the use of Geofoam Blocks in Construction Applications, 2011.
2. Oshati, Olajide Samuel, Valsangkar, Arun J. and Shriver, Allison B., Performance of two cast-in-place box culverts under high embankments, Canadian Geotechnical Journal 49, 1331-1346, 2012.
3. Sun, L., Hopkins,T. C. and Beckham, T. L., Long-Term Monitoring of Culvert Load Reduction Using an Imperfect Ditch Backfilled with Geofoam, Transportation Research Record: Journal of tile Transportation Research Board, No. 2212, Transportation Research Board of the National Academies, Washington, DC, 2011, pp. 56-64.

[1] M. Raafat Ahmed & Mohamed Meguid, Civil Engineering and Applied Mechanics, McGill University, Jim Whalen, P.Eng., Plasti-Fab Ltd , Laboratory Measurement of the Load Reduction on Buried Structures overlain by EPS Geofoam, 2012.