

Analytical evaluation of pressure acting over a buried conduit in reinforced granular soil

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ABSTRACT:

The underground conduits, void or the buried pipes are being used in wide applications since ancient times for carrying oil, water, gas, sewage, slurry, and similar materials from one location to another. A conduit placed in a relatively narrow ditch is known as a ditch conduit and it is often covered with locally available unreinforced earth fill. Designing a buried conduit covered with a granular soil backfill requires that the vertical load acting on the conduit is estimated. Vertical load that develops above buried pipe/ buried conduit often differs from the free-field stress. Arching action of granular soil mass overlying buried conduits can reduce the vertical pressure on buried conduits. The reduction in the load on the conduit happens due to mobilization of the shear resistance along the walls of the ditch during settlement of the backfill within the ditch. However, in some cases, designers need more reduction in pressure acting over the conduit which it would be possible by placing a geosynthetic layer within the soil backfill. This paper represents an analytical method to evaluate the stress reduction on a buried conduit which is reinforced with single reinforcement layer. The vertical pressure acting over the buried conduit is estimated due to simultaneous effects of soil arching action and the geosynthetic layer. A numerical example to evaluate the vertical pressure over the conduit is explained. The effects of various parameters, such as tensile stiffness of reinforcement, elastic modulus of soft material, burial depth of conduit on pressure over the conduit and efficiency is investigated and discussed. Comparison results of reinforced and unreinforced backfill shows a significant effect of reinforcement in decreasing the stress acting on conduit. This reduction is more highlighted when the depth of buried conduit increases. Comparisons of acting pressure on conduit from the present approach shows a satisfactory agreement with those obtained from the other studies, in the same condition, irrespective of unreinforced and reinforced backfill.

Keywords: Arching, Reinforcement, Buried conduit, Vertical pressure, Geosynthetic layer.