

FAILURE MECHANISMS IN SAND OVER A DEEP TRAPDOOR

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Abstract: An experimental testing program was undertaken to investigate failure mechanisms induced by the active movement of a deep rectangular trapdoor underlying a granular soil. Reduced-scale models were tested under normal gravity as well as under an increased gravitational field using a centrifuge facility. Some models were used to evaluate the performance of both flexible and rigid pipes undergoing a localized loss of support. Failure mechanisms in the longitudinal direction of the models were characterized by a single, well-defined failure surface that developed within the limits of the trapdoor. However, failure mechanisms in the transverse direction of the models were characterized by multiple failure surfaces extending outside the limits of the trapdoor. Significant dilation of the soil located immediately above the trapdoor was identified in the failure of the models. The pattern of the failure mechanisms was found to be affected by the stress level and backfill density. Higher stress levels were found to lead to well-developed failure zones. The influence of backfill density was found to be more relevant in models involving flexible pipes. Pipes embedded within loose backfill were severely damaged after loss of support, while pipes embedded in dense backfill experienced negligible deformations. These results indicate that damage to pipelines caused by ground loss of support can be significantly minimized by controlling the compaction of the fill.

Full reference:

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