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Finite elements analysis of an underground collector installed by pipe-jacking method

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This study presents a useful analysis method for estimating simultaneously the stability, stress distribution and groundwater seepage as micro – tunnel is being advanced into the ground. The research is mainly concerned with the results of a case study conducted on a project to create a long industrial collector of effluent network in the east bank of the river Avilés (north coast of Spain). This coastal city has significant port and industrial installations in its environs. The geology of the location comprises Quaternary deposits on both flanks of the estuary and includes different highly variable geotechnical behavior.

The industrial effluent network, constructed in the year 2010, has a length of 13.087 km and consists of 1.5 m diameter pipes, reaching a maximum depth of 5.8 m below the surface. Only the first 7.0 km of the collector (south area) were formed using pipe-jacking method whilst the rest were formed in open excavations or surface laid.

Using the commercial software RS2, a 2D finite element program for soil and rock application, the ground response to pipe jacking in pipeline installation in Avilés was analyzed. Both axi-symmetric and plane strain analyses were carried out in RS2 to simulate in 3D the ground response to pipe advancement. The results demonstrate how much of deformation there is at ground surface in the immediate vicinity of the pipeline. The main objective is to show the possible patterns of ground subsidence and tunnel stresses to inform designers as to whether the tunnel will be stable and safe.