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Stress Analysis of Buried Pipes from Soil and Traffic Loads

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Abstract : Often design standards do not provide guidance or formulae for the calculation of stresses on buried pipelines caused by external loads. Frequently engineers rely on other methods and published sources of information to calculate such imposed stresses and a variety of methods can be used. This paper reviews three current approaches to soil pipeline interaction modelling to predict stresses on buried pipelines subjected to soil overburden and traffic loading. The traditional approach to use empirical stress formulas to calculate circumferential bending stresses on pipelines. The alternative approaches considered are the use of a finite element package to compute an estimate of circumferential bending stress and a proprietary stress analysis system (SURFLOAD) to estimate the circumferential bending stress. The results from analysis using the methods are presented and compared to experimental results in terms of predicted and measured circumferential stresses. This study shows that the approach used to assess externally generated stress is important and can lead to an over-conservative analysis. Using FE analysis either through SURFLOAD or a general FE package to predict circumferential stress is the most accurate way to undertake stress analysis due to traffic and soil loads. Although conservative, classical empirical methods will continue to be applied to the analysis of buried pipelines, an opportunity exists, therefore, in many circumstances, to use applied numerical techniques, made possible by advances in finite element analysis.

Keywords : buried pipelines, circumferential bending stress, finite element analysis, soil overburden, soil pipeline interaction analysis (SPIA), traffic loadings
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