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Advanced Numerical and Analytical Methods for Assessing Concrete Sewers and Their Remaining Service Life

Authors : Amir Alani, Mojtaba Mahmoodian, Anna Romanova, Asaad Faramarzi

Abstract : Pipelines are extensively used engineering structures which convey fluid from one place to another. Most of the time, pipelines are placed underground and are encumbered by soil weight and traffic loads. Corrosion of pipe material is the most common form of pipeline deterioration and should be considered in both the strength and serviceability analysis of pipes. The study in this research focuses on concrete pipes in sewage systems (concrete sewers). This research firstly investigates how to involve the effect of corrosion as a time dependent process of deterioration in the structural and failure analysis of this type of pipe. Then three probabilistic time dependent reliability analysis methods including the first passage probability theory, the gamma distributed degradation model and the Monte Carlo simulation technique are discussed and developed. Sensitivity analysis indexes which can be used to identify the most important parameters that affect pipe failure are also discussed. The reliability analysis methods developed in this paper contribute as rational tools for decision makers with regard to the strengthening and rehabilitation of existing pipelines. The results can be used to obtain a cost-effective strategy for the management of the sewer system.

Keywords : reliability analysis, service life prediction, Monte Carlo simulation method, first passage probability theory, gamma distributed degradation model

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