



## A global approach for urban buried sewers management by considering risk assessment

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A safety factor principle is not sufficient alone to analyze safety reserves in buried urban pipes because of the variation of the phenomena acting on the state of strain and stress in the pipe's wall.

In view of the results of latest European Commission surveys in Europe, more than 200 000 km of small urban sewers needs urgent rehabilitation in next few years. Seen from technical point of view, there is a wide range of rehabilitation methods available on the market (more than 100 technologies). All these techniques have advantages and limits with regard to a specific application. There is no universal method, which is suitable for use in junction with all conceivable marginal conditions. The decision making process is very complicated for the owner of the pipeline who has to integrate many criteria and constraints.

In this paper a semi-probabilistic approach to analyze soil and pipe parameters and to combine all distribution laws is proposed by using a Monte-Carlo approach. This probabilistic approach has to be considered in development of regulations to show the importance of this kind of method. To demonstrate and illustrate the method, some examples are given in the first part of the paper. These examples show:

- the particular characteristics and strengths of the Monte-Carlo method, a method which permits the analysis of parameter sensitivity on the requested strength,
- the definition of determinant factors to be considered when a pipe has to be chosen.

In the second part of the paper, this principle of risk analysis is extended to the life cycle analysis of buried infrastructure pipe by considering technical, environmental and social risks. This approach permits to distinguish components with high urban risks and to suggest analysis methods to understand the consequences of these risks. This kind of semi-probabilistic approach has, in our opinion, to be introduced into all regulation setting processes, particularly for pipeline choice, since such a method permits the determination of an adequate solution that considers both pipeline safety and the project cost. It has the advantage to be able to consider many of uncertainties encountered in urban soil.