

## Towards a better urban water infrastructure asset management by condition assessment and cost modelling

### Summary

Infrastructure asset management (IAM) has been increasingly becoming a key topic in the mind-set shift of the water sector managers and policy makers, allowing to assist in the operational, tactical and strategic decision-making in urban water infrastructures. Nevertheless, IAM implementation by the water utilities is still far from needed and not widespread, due to several challenges and constraints, mainly associated with limited human, technological and financial resources.

The current research aims to enhance urban water infrastructure asset management through an integrated decision-making approach, that includes novel methodologies for condition assessment, service life prediction and cost modelling. This approach can be applied at three assessment levels – macro, meso and micro – allowing the identification of intervention priority assets and the study of different long-term rehabilitation solutions, when applied at the meso and macro level, and the diagnosis, prioritization and study of different intervention solutions at the micro assessment level.

The decision-making approach encompasses relevant scientific developments in condition assessment, service life prediction and cost modelling. A comprehensive distress-based condition assessment approach specifically tailored to evaluate the physical condition of vertical assets is proposed, through the identification and classification of anomalies using a new standardized visual inspection system. A novel methodology for service life prediction through the development of deterioration models is presented, allowing to study the influence of physical, operational and environmental variables on the asset deterioration and to validate the reference service lives in Portugal. A systematic methodology to determine reference costs for different types of interventions in urban water assets during their life-cycle is also proposed, allowing to improve the assessment and the selection of solutions.

The application of scientific developments is carried out in a large dataset of assets from water utilities with different maturity levels and infrastructural and operational knowledge. The main outcomes of this research are: (i) the proposal of three novel indices to calculate the average and the maximum deterioration index of components, assets and infrastructures; (ii) the development of deterioration models and the prediction of service lives for storage tanks and wastewater pumping stations; (iii) the estimation of reference costs for the most common interventions in urban water assets; and (iv) the proposal of an integrated decision-making approach incorporating the new scientific insights towards a better urban water infrastructure asset management.

### Keywords

Infrastructure asset management, condition assessment, service life prediction, cost modelling, decision-making, urban water assets.



#### PhD student

Marta Sofia Ferreira Cabral

#### PhD program

Civil Engineering (IST, University of Lisbon)

#### Supervisor

Dídia Covas (CERIS, IST, University of Lisbon)

#### Co-supervisor

Dália Loureiro (LNEC)

#### Period

2017-2021

#### Funding

FCT scholarship (SFRH/BD/117717/2016)