## Coating Selection and Prediction of the Service Life of Polymeric Protective Coatings for Sewers Based on Accelerated Testing

### Background

Concrete sewer pipes are subject to corrosion resulting from acids (e,g., sulfuric acid, citric acid) and gases ($CO_2$, $H_2S$, $SO_2$ and $NO_2$) that are generated by microorganisms in the sewers. Polymeric coatings, for example epoxy and epoxy mortars are used to isolate the pipes from theses acids and gases to prevent corrosion. Acids and gases are able to permeate through the coatings to corrode the pipes. An important feature of the performance of protective coating is its resistance to acid permeation.

### Project Description

At the University of Sydney, School of Chemical and Biomolecular Enginering, our research team developed performance model(s) to predict the service life of protective polymeric coatings from the known physical and chemical properties of the coating and environmental conditions. The structure of the performance model(s) are shown in Figure 1. The life of the coating is defined to have ended once the acids fully permeate the coating. In this study an approach to estimate the service life of coating is based on the prediction of acid permeation profiles through the coatings with time. The coatings employed consisted of commercially available epoxy, epoxy mortar, epoxy novolac and polyurethane coatings. Accelerated acid permeation tests were performed in coatings with nominal thickness of 3 to 20 mm in 10 g/L to 100 g/L of sulphuric, citric acid, oxalic and nitric acids as surrogate conditions for the corrosive environment.

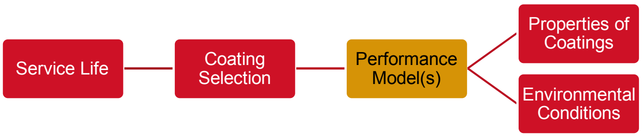


**Figure 1. Structure of performance models to predict the service life of protective coatings**

### Applications

These model(s) will enable:

***Coating selection fit for purpose***: to compare the predicted performance of various coatings for given corrosive conditions (see Figure 1)

***Design of protective coatings***: to predict performance of coatings of various thickness (see Figure 2)

***Post monitoring of coating performance***: given the condition assessment provides a tool for estimating the remaining life of the coating.

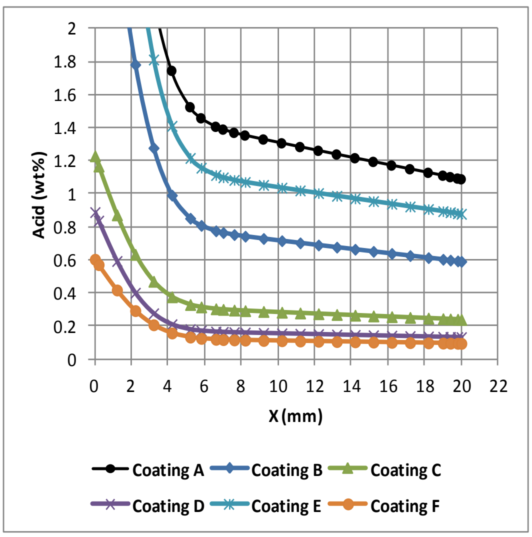


**Figure 1. Acid permeation in polymeric coating in 100 g/L citric acid within 15 years.**

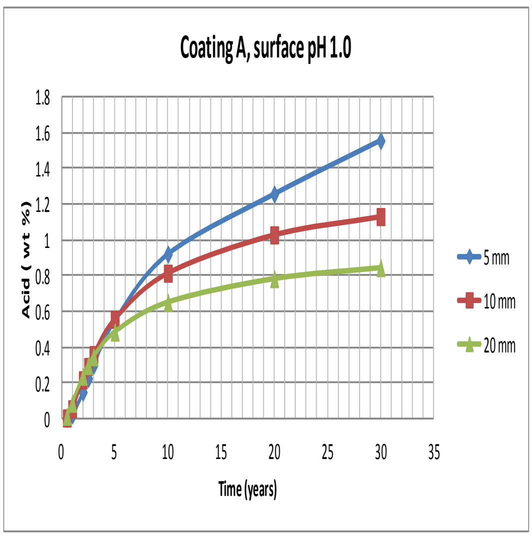


**Figure 2. Service life with coating thickness in sulphuric acid**