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Role of Spatial Variability in the Service Life Prediction of Reinforced Concrete Bridges Affected by Corrosion

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Abstract : Estimating the service life of Reinforced Concrete (RC) bridge structures located in corrosive marine environments of a great importance to their owners/engineers. Traditionally, bridge owners/engineers relied more on subjective engineering judgment, e.g. visual inspection, in their estimation approach. However, because financial resources are often limited, rational calculation methods of estimation are needed to aid in making reliable and more accurate predictions for the service life of RC structures. This is in order to direct funds to bridges found to be the most critical. Criticality of the structure can be considered either form the Structural Capacity (i.e. Ultimate Limit State) or from Serviceability viewpoint whichever is adopted. This paper considers the service life of the structure only from the Structural Capacity viewpoint. Considering the great variability associated with the parameters involved in the estimation process, the probabilistic approach is most suited. The probabilistic modelling adopted here used Monte Carlo simulation technique to estimate the Reliability (i.e. Probability of Failure) of the structure under consideration. In this paper the authors used their own experimental data for the Correlation Length (CL) for the most important deterioration parameters. The CL is a parameter of the Correlation Function (CF) by which the spatial fluctuation of a certain deterioration parameter is described. The CL data used here were produced by analyzing 45 chloride profiles obtained from a 30 years old RC bridge located in a marine environment. The service life of the structure were predicted in terms of the load carrying capacity of an RC bridge beam girder. The analysis showed that the influence of SV is only evident if the reliability of the structure is governed by the Flexure failure rather than by the Shear failure.

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