ABSTRACT

Steel corrosion in concrete is the dominant variable contributing to the reduced service life of concrete structures. Corrosion reduces the cross-section of the rebar, weakens the steel-concrete bond, develops cracks and spalls concrete covers, and some instances, it may increase deflection and buckling. Safety is a major concern of corroding concrete structures, and to minimise the risk; appropriate measures are to be taken in deciding when and how to implement maintenance. The influential factor that governs or informs such decisions is the corrosion damage quantification. However, the current non-destructive methods of corrosion damage quantification often lead to ambiguity, and most do not evaluate corrosion damage in terms of rebar cross-section loss, which is the primary effect of steel corrosion in concrete.

Consequently, this study presents a non-destructive model for quantifying corrosion damage in reinforced concrete structures using the corrosion-induced crack width. This model is effective, less complicated, applicable to structures in service, and permits the evaluation of the corrosion damage in terms of the residual cross-section. Moreover, the derived model requires input parameters that are easily attainable both in the laboratory and the field. This model was derived based on experimental and numerical investigation of the relationship between the corrosion-induced crack width and the rebar cross-section loss. The derived model was tested against the author's experimental data and data from the literature which include natural and accelerated corrosion as well as loading conditions, and the results correlate well with these data.