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A time-variant model of surface chloride build-up for improved service life predictions

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Abstract

Current service life models for predicting the time to chloride-induced corrosion initiation of steel reinforcement in concrete structures are based on a hypothesized surface chloride concentration, C_s , as a boundary condition. This is either assumed to be constant or varies with time, generally disregarding other factors that influence C_s . For example, Fickian models use a constant C_s and existing time-variant models assume C_s is only a function of time. In this paper, an improved time-variant C_s model is hypothesized using general physical concepts and is then validated by an empirical study. The proposed model, as opposed to the existing time-variant models, not only accounts for the variability of C_s with exposure time but also incorporates the effects of time to exposure and the effects of the concentration of chlorides in the exposure environment. The model assumes that C_s is sigmoidal in shape with an asymptote that is a function of the concentration of chlorides in the environment. The input variables for the proposed model were selected based on best subset sampling analysis on the results of the experimental work to determine the influence of water-to-cement ratio, time to exposure, the concentration of chlorides in the exposure environment, and exposure time on C_s . The accuracy of the proposed model is assessed versus existing time-variant C_s models and the results indicate

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