CMDWC 2021

MDPI

Article

Evaluation of chloride-ingress models on concrete bridge exposed to deicing salts

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Abstract: Numerical models for chloride transport in concrete have been improved in the last four decades, however, their application to existing structures is still not at a satisfactory level. While simple models have many limitations that cannot be applied to existing structures in a real environment, more comprehensive models for service life prediction are not suitable for everyday engineering practice. Two chloride ingress models, a more comprehensive 3D chemo-hygro-thermo mechanical (CHTM) model implemented into the MASA software and well-known Life-365, are used for a case study: motorway bridge in the mountain region in Croatia. Both models are capable to predict the chloride content in concrete and match well with measured data on the bridge after 11 and 14 years of exposure to deicing salts. However, calibration with measured results led to higher values of surface chloride content and initial chloride diffusion coefficient for numerical analyses using the Life-365, which assumes that the concrete is uncracked and the surface chloride content is constant. On the other hand, the 3D CHTM model considers more realistic conditions: variable temperature, surface water and chloride contents, wetting and drying cycles, chloride diffusion and convection in cracked and un-cracked concrete. Consequently, input values for chloride diffusivity and surface chloride content do not require calibration for each chloride profile, as is the case for the Life-365 application.

Keywords: chloride diffusion, numerical model, concrete bridge, wetting-draying cycles, crack, numerical analysis, chloride content, de-icing salts.