

Title: Statistical Variations in Chloride Diffusion in Concrete Bridges

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Abstract: Designing structures for longer life requires that a reliable means be developed to predict the mechanisms related to durability. The paper introduces the simulation-based reliability assessment (SBRA) method for the probabilistic prediction of chloride diffusion. Data are presented from the in-place measurement of chloride penetration and concrete cover from more than 200 samples taken from 40 bridge decks in the northeastern U.S. The bridge decks were constructed under identical construction and design specifications over a 13-year period and exposed to deicing salts as well as normal environmental cycles. The paper illustrates the effect of variations in diffusion coefficients and cover depths using histograms. The research used Monte Carlo simulation to evaluate Fick's second law using an expansion solution to Crank's error function. The result shows that the initiation of corrosion from the diffusion of chlorides can be delayed for decades by using high-performance concrete with lower diffusion coefficients.