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Guide to Remediate Bridge Deck Cracking

Mohamed ElBatanouny, Wiss, Janney, Elstner Associates, Inc.

Marwa Abdelrahman, Wiss, Janney, Elstner Associates, Inc.

Kathleen Hawkins, Wiss, Janney, Elstner Associates, Inc.

John Lawler, Wiss, Janney, Elstner Associates, Inc.

Todd Nelson, Wiss, Janney, Elstner Associates, Inc.

Paul Krauss, Wiss, Janney, Elstner Associates, Inc.

Abstract

Early-age cracking of concrete bridge decks is a common issue reported among state departments of transportation (DOTs) and other transportation agencies. This cracking is one of the main issues that affects the durability of concrete bridge decks, especially in states where de-icing salts are used. Cracks facilitate the ingress of chlorides and moisture, which can lead to corrosion damage of reinforcing bars. Due to the undesired effects of cracking on bridge deck service life, the Iowa Department of Transportation (Iowa DOT) sponsored this study to develop a comprehensive guide for remediating cracks in bridge decks in Iowa. The study included a literature review of state DOTs' practices for bridge deck crack remediation as well as the beneficial effect of crack repair on service life extension compared to a do-nothing scenario. It is noted that the latter was identified as a research gap in the literature search because, while the theoretical effects of cracking on service life are well documented, quantitative research in this area is rare. Several crack remediation techniques were selected as potential means to improve the service life of cracked bridge decks including penetrating sealers, flood coats (also known as healer-sealers), crack chasing, hot-mix asphalt (HMA) overlays with waterproofing membranes, thin polymer overlays, and premixed polymer overlays. An extensive service life modeling effort using WJE CASLE software was completed to investigate the effect of these remediation techniques on service life based on our current understanding of the beneficial effects of the different repair methods. A life-cycle cost analysis was then completed to investigate the benefit-to-cost ratio of applying the different repair methods at certain intervals within 10 years of bridge deck construction compared to a do-nothing scenario. Decision trees were developed to aid in the selection of the optimal crack remediation option based on several inputs including crack width, crack density, service life extension and life-cycle cost. A compilation of best practices for application of the different crack remediation options as well as recommendations for future research were provided.