

Textured Epoxy Coated and Galvanized Reinforcement to Control Cracking in Concrete Bridges

Research Objectives

- Evaluate the influence of different reinforcing bar surface coatings on crack control performance
- Provide specs and guidelines for improving crack-control performance

Research Benefits

- Develop an understanding of the crack control performance advantages and disadvantages of reinforcement surface texture
- Develop specifications for the potential use of textured reinforcement on Wisconsin Projects

Background

Bridge owners have searched for ways to control cracking of concrete bridge decks and components to slow deterioration. While some degree of cracking is generally expected and accepted, it is desirable to minimize the cracking to reduce the intrusion of water and deicing chemicals into the concrete. This project evaluated the influence of different reinforcing bar surface coatings on crack control performance.

Methodology

Five different reinforcing bar coatings were considered: black (uncoated), conventional (smooth) epoxy, textured epoxy, hot-dipped galvanized and continuously galvanized coatings.

Five different series of laboratory tests were conducted to evaluate the impact of coatings on bar-concrete bond, static flexural cracking, cyclic flexural cracking and shrinkage cracking.

Two field studies were conducted. The same bridge construction project was used for both studies, with the first study focusing on the cast-in-place concrete bridge deck and the second focusing on the precast-pretensioned concrete girders. Half of the concrete deck was reinforced with textured epoxy-coated bars and the other half was reinforced with hot-dipped galvanized bars.

In the second field study, smooth epoxy, textured epoxy, and hot-dipped galvanized bars were alternately used as confinement reinforcement in the girders' bottom flanges. End region cracks were compared in the days following prestress transfer.

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*Bridge Deck Reinforcement
(Hot-Dipped Galvanized /Textured
Epoxy Coated)*

“This research gives WisDOT a better understanding of the influence reinforcement surface texture has on controlling cracks in concrete. This project also developed a specification for future implementation of textured epoxy-coated bars.”
– James Luebke, WisDOT

Interested in finding out more?

Final report is available at:
[WisDOT Research website](#)

Results

Table 1 – Summary of crack control performance of bar types. Percentages are relative to the average performance of all bar types in comparable tests.

Bar Type	Performance in Load Cracking Tests	Performance in Shrinkage Cracking Tests
Black (uncoated)	10% better	2% worse
Textured epoxy-coated	15% better	15% better
Smooth epoxy-coated	27% worse	8% worse
Hot-dipped galvanized	Not tested	5% better
Continuously galvanized	3% worse	8% worse

Recommendations for implementation

Based on the results of the project, the research team makes the following recommendations:

- Textured epoxy and hot-dipped galvanized bars provided superior crack control performance in laboratory tests relative to the smooth epoxy bars. Textured epoxy and hot-dipped galvanized bars are recommended as alternatives for reinforcement in concrete bridge decks.
- Continuously galvanized bars performed the same as or better than the smooth epoxy bars in lab tests. Continuously galvanized bars should receive consideration as an alternative reinforcement for concrete bridge decks.
- Laboratory and field tests should be conducted to compare alternative bar coatings' corrosion mitigation effects and life-cycle costs. These topics are beyond the scope of the current project; however, they are essential criteria for selecting reinforcement coatings.
- The use of textured epoxy-coated and hot-dipped galvanized bars as confinement reinforcement in precast concrete girders is neither encouraged nor discouraged. These alternative bars did not provide consistent advantages or disadvantages in the field study.
- Future visits should be made to the case study bridge to evaluate the long-term performance of the textured-epoxy and hot-dipped galvanized reinforcement. Such visits should evaluate crack control and the extent of and rebar corrosion.

This brief summarizes Project 0092-19-01,
 “Textured Epoxy Coated and Galvanized Reinforcement to Reduce
 Cracking in Concrete Bridge Decks and Components”
 Wisconsin Highway Research Program