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Durability, Service Life, and Long-Term Integrity of Concrete Materials, Bridges, and Structures

SP-351

Editors:
Yail J. Kim, Chris P. Pantelides, and Xianming Shi

American Concrete Institute
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Durability, Service Life, and Long-Term Integrity of Concrete Materials, Bridges, and Structures

Durability is one of the most important requirements for built-environments. Federal, state, and local agencies expend significant effort to maintain the quality and condition of aging civil infrastructure, especially in aggressive service environments. Among many factors, durability influences the service life, integrity, and reliability of concrete materials and structures. Extensive research has been conducted to understand the deterioration mechanisms of concrete in an effort to extend the longevity of concrete members. This Special Publication (SP) contains nine papers selected from three technical sessions held during the virtual ACI Fall Convention in October 2021. Emphasis is placed on durable reinforcing schemes, service life prediction, structural integrity, repair and retrofit, corrosion mitigation, inspection techniques, and the application of state-of-the-art construction materials. All manuscripts were reviewed by at least two experts in accordance with the ACI publication policy. The Editors wish to thank all contributing authors and anonymous reviewers for their rigorous efforts. The Editors also gratefully acknowledge Ms. Barbara Coleman at ACI for her knowledgeable guidance.

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TABLE OF CONTENTS

Axial Compression Capacity of Concrete Columns Reinforced with GFRP and Stainless Reinforcement

J.W. Wright and C.P. Pantelides

Synopsis: Axial compression performance of concrete columns reinforced with GFRP bars and spiral, 2304 duplex stainless bars and spiral, and 316L stainless clad bars, in varying combinations is examined after exposure to accelerated corrosion. The hybrid columns were reinforced with a combination of metallic and GFRP reinforcement. After corrosion exposure the columns were tested under axial compression to failure. Columns with GFRP vertical bars and stainless steel spiral were less corrosion resistant and had smaller axial load capacity than hybrid columns with stainless clad or stainless steel vertical bars and GFRP spiral. Columns reinforced with stainless steel spiral achieving two to three times the maximum axial displacement of columns with GFRP spiral. Axial compression capacity of hybrid columns in both corroded and uncorroded conditions was modeled using concrete confinement models for metallic and GFRP reinforcement with good agreement.

Keywords: carbon steel, columns, concrete, corrosion, glass fiber reinforced polymer, stainless clad, stainless steel.