Proceedings of

the International Symposium on Life Cycle Maintenance of Concrete Infrastructure

25-26 September 2023

Hong Kong, China

Editors

J.G. Dai and Y. Dong

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學
Opening Minds • Shaping the Future • 啟迪思維 • 成就未來

BOND DEGRADATION IN RC MEMBERS WITH INDUCED CRACKS DUE TO REBAR CORROSION

T. Kanakubo[1*] and A. S. Syll[2]
[1] Division of Engineering Mechanics and Energy,
University of Tsukuba, Ibaraki, Japan. Email: kanakubo@kz.tsukuba.ac.jp
[2] Department of Building Technologists,
Institute of Technologists, Saitama, Japan.

ABSTRACT

Corrosion of rebars in reinforced concrete (RC) is a severe problem for existing concrete structures used for many years. The volume of steel increases due to expansive corrosion products, and they cause the cracking of surrounding concrete. Researchers have been studying bond degradation between rebars and concrete, which significantly impacts the resistance of RC members in bending, shear, anchorage, etc. In laboratories, rebars' corrosion is typically simulated using the electrical-induced corrosion method. Previous results have shown that the bond strength increases at low corrosion levels and decreases with higher levels of corrosion. The authors have focused on the induced cracks in surrounding concrete that significantly affects the confinement of rebars and directly causes the bond degradation. The authors have explored bond deterioration owing to corrosion-related cracking using a novel crack simulation approach. To simulate the volumetric expansion of the rebar due to corrosion, aluminum pipes are inserted into the concrete and filled with an expansion agent (Expansion Agent Filled Pipe, EAFP). The series of pull-out bond tests were conducted using specimens cracked by EAFP. The EAFP can be a promising method for investigating the effect of cracking in isolation with other factors such as the reduction of cross-section of rebars. With the increase of the crack width over elapsed time from filling the aluminum pipe with an expansion agent, a target crack width can easily be obtained. The bond strength decreases considerably with increasing induced crack width in specimens without stirrups. However, the bond strength degradation becomes smaller by stirrup-confinement. Empirical models are proposed to assess the bond strength degradation according to induced crack width and the stirrup ratio.

KEYWORDS

Corrosion; Bond strength; Pull-out test; Crack width; Expansion agent; Confinement; Stirrup ratio

Corresponding author's contact information:

Mail address: Division of Engineering Mechanics and Energy, University of Tsukuba, 1-1-1, Tennohdai, Tsukuba, Ibaraki, Japan
Tel: +81 298535045
Email: kanakubo@kz.tsukuba.ac.jp

Presenting Author' Biography

Professor Kanakubo's research themes are "Structural Assessment of Existing Concrete Structures" and "Newly Development of Resilient Structures with Non-Traditional Materials". He is a member of Concrete Housing Structure Examination Committee in the Building Center of Japan, Sub-Committee for Design and Construction of High-Strength Fiber-Reinforced Cementitious Composites in Japan Society for Civil Engineers, and other committees. He is a chair of ISO/TC71/SC6, Non-traditional reinforcing materials for concrete structures.