



Strengthening and Retrofitting of Damage and Corrosion Concrete Columns with CFRP Composites

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Abstract

High compressive strength, high performance and suitable combination with reinforcements are efficient factors in application of concrete. But stability and durability is important problem in concrete projects that must has been attended. Nowadays, retrofit and strengthening of structures has been greatly concerned by the civil and structural engineers. A new class of retrofitting methods has been developed using the versatile chemical products like as polymers, resins and reinforcement fibers. Because of several parameters, a structure sometimes needs to retrofit and improve. These structures have been retrofitted with concrete and steel jackets. But these methods have many difficult and limitation of construction. One of the new methods for retrofitting and strengthening of structures is application of advanced fiber reinforced polymer composites. The behavior and performance of these columns were analyze and evaluated in this study. A finite element analysis using ANSYS is utilized to conduct a parametric study. Effects of repairing concrete cover and the CFRP wrapping on the performance of column are investigated. Concrete column has been modeled in 4 states: Before corrosion, after corrosion, after repair and after wrapping with FRP. The wrapping of CFRP applied fully over the cylindrical columns height. It is shown that ductility and strength of columns submitted to axial load after corrosion of reinforcing bars, and spalling of concrete cover significantly decreases, whereas after repairing the concrete cover, strength is not compensated. Results show that applying CFRP wraps significantly compensate ductility and strength reduction of original column.

Keywords: Concrete, Corrosion, Retrofit, CFRP, Finite Element Method

1. Introduction

Today the strengthening of structures in civil engineering is one of the major branches. There are structures in different places that still have not completed their useful life But due to various factors such as environmental damage is the major structural injuries Or structures are that Applied load More than their design load .Or some of the structures that have been used in their implementation of inappropriate materials Or other errors occurred during the execution Which Has caused the structure to be weak. Such structures with concrete or the steel sheets can be strengthened. Today's industry has achieved the technology that of carbon, glass and aramid materials to produce which are much lighter and more resistant than steel. And these polymers are very convenient and rapid solutions for strengthening of such structures.

Increase the compressive strength of concrete due to wrap external FRP, was investigated first by Fardis and Khalili [1]. And In the mid-1980s the idea of retrofitting reinforced concrete columns were used in Japan.

In 2001, Lam and Teng had suggested that modified form of square or rectangular columns with circular or oval-shaped column reinforcement can be applied to them [2].

About the failure modes and behavior of concrete columns with circular cross-section Lam and Teng many studies done And reported Rupture may occur within the time FRP tensile strength to reach the circular stress [2].

Xiao and Wu in 2000 based on research conducted Showed that Stress-strain curves of concrete confined with FRP in circular columns has two lines property with a gentle gradient in the transition zone is not confined concrete stress level Except in the case of FRP used is very low [3].

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