

Retrofitting concrete slabs using FRP composite fibers

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Abstract

Today, using polymer composites reinforced by FRP fibers for reinforcing concrete structures and restoration and retrofitting various building in order to bear double loads of design and increasing plasticity has become very common. In the past, concrete and steel jackets were mostly used that were usually placed as an external coverage on the structure body. FRP composites are intensely resistant against alkaline and salty environments and in recent decades, it has been the subject of wide studies for complete replacement with steel slabs and bars. FRP composite fibers due to their high strength against corrosion, ease of shipment and easy installation and low weight are increasingly used. By introducing these composite materials in civil engineering, FRP fibers by having appropriate properties are an optimal option for retrofitting concrete members like beams, columns and slabs. Slabs retrofitted by FRP composites have higher final strength and better bending behavior comparing slabs reinforced by steel, while their plasticity and crack width is more than slabs reinforced by steel.

Keywords: reinforced concrete structures, concrete slabs, composite sheets, retrofitting, FRP.

1. Introduction

In recent years, wide studies have been performed on using FRP fibers for restoration and retrofitting various structures. Some of these studies have been performed based on method of replacement of FRP fibers with concrete and steel jackets. Today, FRP composites are widely used in retrofitting structures. Generally, using composites started from 1940 and it was at first used in military industries and aerospace, so that after Second World War using polymeric composites in missile industries of U.S.A and Western Europe countries increased about 80%. Their low weight and suitable strength causes their wide application in construction industry, automobile manufacturing and construction of skeletons and ships. Today, FRP composite fibers are used in several cases. In mid-1980, Dr. Meyers in Switzerland investigated attaching FRP sheets to slabs, columns, beams and other members and sections of the structure. The results obtained from his tests about wrapping up structural elements using composites were very successful. Japanese engineers after performing some tests and studies found out that using FRP fibers is an appropriate strategy for retrofitting structures against severe earthquakes. For the first time, they introduced this composite fiber as a suitable material for restoration and reinforcement of structures. American Concrete Institute has now codified a comprehensive guideline for using FRP composites called ACI 440 regulation. Today, the usage rate of these materials in the society is numerated as one of indicators of being developed.