An integrated system for enhancing flexural members' capacity via combinations of the fiber reinforced plastic use, retrofitting, and surface treatment techniques

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Abstrak

This paper elaborates on the theoretical background, necessity, and techniques for enhancing the flexural capacity of a T-section member under combined bending and shear. The paper is based on a continuing research program seeking solutions to the design disparities arising from the introduction of new seismic codes and revised earthquake mapping prior to the tsunami and major earthquakes that occurred in South East Asia more than a decade ago. The research considered the application of external reinforcement using fiber-reinforced polymer (FRP) sheets, creating confinement in the shear area, and improving the tensile strength zone. The test results suggested that the methods sufficiently increased the load-carrying capacity to meet the new provisions, but they also showed that the optimum load-carrying capacity was not reached due to debonding of the FRP sheets in the tensile zone. The work was expanded to search for a surface treatment method that could shift the failure mode from debonding to FRP rupture by performing direct shear tests on treated FRP-to-concrete bond surfaces. Using the best surface treatment method, a failed member was straightened, retrofitted, and re-reinforced in terms of both shear and tension. The experimental results showed that the load-carrying capacity of the flexural member not only increased significantly, but the surface treatment methods also overcame the interface debonding problem. This research provides a method for upgrading the flexural capacity of T-section members designed prior to the tsunami and earthquakes of 2004, and it offers a solution for cracked section repair and restoration.