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A Study on Reinforced Concrete Beams Enlarged with Polymer Mortar and UHPFRC

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Abstract : Many studies have been done on the repair and strengthening method of concrete structure, so far. The traditional retrofit method was to attach fiber sheet such as CFRP (Carbon Fiber Reinforced Polymer), GFRP (Glass Fiber Reinforced Polymer) and AFRP (Aramid Fiber Reinforced Polymer) on the concrete structure. However, this method had many downsides in that there are a risk of debonding and an increase in displacement by a shortage of structure section. Therefore, it is effective way to enlarge the structural member with polymer mortar or Ultra-High Performance Fiber Reinforced Concrete (UHPFRC) as a means of strengthening concrete structure. This paper intends to investigate structural performance of reinforced concrete (RC) beams enlarged with polymer mortar and compare the experimental results with analytical results. Nonlinear finite element analyses were conducted to compare the experimental results and predict structural behavior of retrofitted RC beams accurately without cost consuming experimental process. In addition, this study aims at comparing differences of retrofit material between commonly used material (polymer mortar) and recently used material (UHPFRC) by conducting nonlinear finite element analyses. In the first part of this paper, the RC beams having different cover type were fabricated for the experiment and the size of RC beams was 250 millimeters in depth, 150 millimeters in width and 2800 millimeters in length. To verify the experiment, nonlinear finite element models were generated using commercial software ABAQUS 6.10-3. From this study, both experimental and analytical results demonstrated good strengthening effect on RC beam and showed similar tendency. For the future, the proposed analytical method can be used to predict the effect of strengthened RC beam. In the second part of the study, the main parameters were type of retrofit materials. The same nonlinear finite element models were generated to compare the polymer mortar with UHPFRCC. Two types of retrofit material were evaluated and retrofit effect was verified by analytical results.

Keywords : retrofit material, polymer mortar, UHPFRC, nonlinear finite element analysis
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