

Performance of Steel I-Beams Strengthened by Fastening Hybrid FRP Strips

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Abstract - Fiber-Reinforced Polymers (FRPs) have been widely used in strengthening steel structures. Few researches were conducted to verify the adequacy of strengthening steel structures by fastening FRPs. The current paper reports on the outcomes of an experimental study aimed at strengthening steel I-beams by fastening hybrid FRP (HFRP) strips. A total of ten UB203x102x23 beams were tested in a four-point loading setup. Steel bolts were used to fasten the HFRP strips to the beam bottom flange. The effect of HFRP length was assessed by considering three scenarios (1,620, 1,170 and 810 mm) that correspond to 90%, 65% and 45% of the clear span length of tested beams. Single and double HFRP strips were utilized to evaluate the effect of HFRP thickness on the performance of the strengthened beams. Staggered and uniform bolt arrangements were used to assess the effect of bolt arrangement on the performance of the fastened systems. All strengthened beams exhibited better yield and ultimate strength as compared to the control beam. Fastening two HFRP strips with lengths of 90% of the beam clear span revealed 21% enhancement in the ultimate capacity of the strengthened beam.

Keywords: Hybrid fiber-reinforced polymers (HFRP), strengthened beams, HFRP length, HFRP thickness, bolt arrangement, four-point loading.