



论文摘要

中南大学学报(自然科学版)

ZHONGNAN DAXUE XUEBAO(ZIRAN KEXUE BAN)

Vol.41 No.3 Jun.2010

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文章编号: 1672-7207(2010)03-1165-07

负载下CFRP与钢板复合加固钢筋混凝土梁 抗弯试验及设计理论

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摘要: 模拟实际构件的加固及受力过程, 对不同负载下外贴碳纤维复合材料(CFRP)与钢板复合加固梁进行受弯试验与理论分析。试验梁4根, 其中CFRP与钢板复合加固梁3根和对比梁1根。研究负载下CFRP与钢板复合加固梁的抗弯性能及负载水平对其的影响。最后推导负载下复合加固梁的抗弯极限承载力、挠度及裂缝宽度计算公式。实验结果表明: 复合加固梁的承载力和抗弯刚度都显著提高, 且破坏时复合加固梁具有较好的延性; 负载对梁的承载力几乎没有影响, 可以忽略, 但对梁的抗弯刚度和裂缝宽度影响显著, 尤其是在屈服阶段前; 承载力、挠度和裂缝宽度的计算结果与试验数据较吻合, 可供实际工程加固设计参考。

关键词: 负载水平; 碳纤维复合材料; 钢板; 钢筋混凝土梁; 复合加固; 抗弯性能

Flexural behavior and design theories of CFRP-steel plates composite strengthened reinforced concrete beams at different preloaded levels

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Abstract: Flexural behavior of the CFRP-steel plate composite strengthened beams and the effects of different preloaded levels on flexural behavior were investigated. Four reinforced concrete beams including three CFRP-steel plate composite strengthened beams and one control beam were tested, and the theoretical analysis was conducted to explain the experimental phenomena and test results. Finally, the calculation formulas of ultimate flexural load-carrying capacity, deflections and crack width of the composite strengthened concrete beams were presented. Both the experimental and analytical results indicate that the flexural capacity and stiffness of all the composite strengthened beams are enhanced evidently as compared with that of the control beam, and the damage of the composite strengthened beams has preferable ductility. The preloaded levels have little effect on load-carrying capacity of the composite strengthened beams, but the preloaded levels have an obvious effect on the stiffness and crack width of the composite strengthened beams, especially reinforcements yield stage before. Through comparing the theoretical results with the test, the calculation results agreed well with the test results and the formulas can be used as references for strengthening design.

Key words:preloaded levels; carbon fiber reinforced polymer (CFRP); steel plate; reinforced concrete beam; composite strengthening; flexural behavior

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