建筑结构学报 2011, 32(5) 107-115 DOI: ISSN: 1000-6869 CN: 11-1931/TU

学术论文

预应力预制叠合梁受弯性能试验研究

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摘要：

传统预应力混凝土叠合梁大多采用矩形截面，存在自重大、运输及吊装困难等问题，提出了U形与倒T形两种预应力预制叠合梁。进行了3根U形预应力预制叠合梁、3根倒T形预应力预制叠合梁与1根整浇梁的对比试验，研究其破坏机理、受弯承载力、短期刚度、变形特征及裂缝分布等，并将试验结果与规范计算结果进行了对比。研究结果表明：从开始加载到破坏，叠合梁与整浇梁表现出相同的受力特点和变形特征；叠合梁的开裂弯矩、极限弯矩计算结果与实测值吻合较好，按整浇梁计算时比真实结果偏于安全；叠合梁的短期刚度及平均裂缝间距实测值与计算结果吻合较好。采用有限元程序ANSYS10.0进行模拟计算，计算结果与试验结果吻合良好。有限元结果表明：配筋适当的叠合梁与整浇梁的整体破坏特征基本相同；对于采用自然粗糙面的叠合梁，可不考虑叠合面相对滑移而按整浇梁进行计算分析。

关键词： 叠合梁 预应力 预制构件 静力试验 有限元分析 受弯性能

Experimental study on flexural behavior of prestressed precast component composite beams

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Abstract:

U-shaped and inversed T-shaped prestressed precast component composite beams(PPCCB) were proposed to overcome the disadvantages of traditional prestressed concrete composite beams such as heavy self weight and the difficulty in transportation and erection due to the use of rectangular cross section. Three U-shaped PPCCB, three invertible T-shaped PPCCB and a cast-in-situ beam were tested. Failure mechanism, flexural capacity, short-term rigidity, deformation behavior and crack distribution were studied. Differences in cracking moment, ultimate bending moment, short-term rigidity and average crack interval between the calculated values based on the current code method and the experimental results were analyzed. Experiment results indicate that PPCCB and the cast-in-situ beam exhibit similar load carrying capability and deformation property. The calculated values of cracking moment, ultimate bending moment, short-term rigidity and average crack interval for PPCCB agree well with testing values. The calculated values of cracking moment and ultimate bending moment for PPCCB according to the cast-in-situ beams are more conservative than actual results. The finite element analysis by ANSYS10.0 program was conducted and the results between test and analysis are close. Numerical simulation shows that overall failure features of PPCCB with appropriate reinforcement are basically the same as that of cast-in-situ beam. For the composite beams with natural rough surface, it becomes feasible to analyze without considering the behavior of interface slip.

Keywords: composite beam prestress precast component static test finite element analysis flexural behavior

收稿日期 修回日期 网络版发布日期

DOI:

基金项目:

国家自然科学基金项目（50978090），湖南省研究生科研创新项目（CX2010B143）。

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