

学术论文

内置灌浆圆钢管桁架预应力混凝土连续梁受力性能试验研究和理论分析

张博一, 郑文忠, 王雪英

哈尔滨工业大学 土木工程学院, 黑龙江哈尔滨 150090

摘要:

为探索内置灌浆圆钢管桁架预应力混凝土连续梁的塑性内力重分布规律, 进行了3根无粘结内置灌浆圆钢管桁架预应力混凝土连续梁的受力性能试验和6根模拟梁的非线性数值模拟分析, 论述了这类梁设计用和检测评价用的两类承载能力极限状态及试验梁塑性内力重分布情况。试验结果表明, 内置灌浆圆钢管桁架预应力混凝土连续梁正截面承载力极限状态应以任一跨出现荷载开始减小, 位移急剧增大为标志; 这类连续梁塑性内力重分布及弯矩调幅过程集中体现在中支座塑性铰形成的转动过程中; 采用条带分层法进行截面的M- 非线性分析, 基于试验结果和数值分析结果, 分别建立了使用阶段和两类承载能力极限状态下无粘结预应力筋应力增量的计算公式, 获得了两类承载能力极限状态下中支座两侧的塑性铰区长度实测值, 并拟合得到相应等效塑性铰区长度的计算公式, 建立了两类承载能力极限状态下的以中支座与跨中控制截面综合配筋指标 $\beta_{o,i}$ 、 $\beta_{o,m}$ 为自变量和以中支座控制截面相对塑性转角 θ_p 为自变量的内力重分布系数 Δ 的计算公式。

关键词: 灌浆圆钢管桁架 无粘结预应力 混凝土连续梁 静力试验 理论分析 塑性铰 弯矩调幅

Analysis and experimental research on load-bearing behavior of grouted-round-steel-tube truss-prestressed concrete continuous beam

ZHANG Boyi, ZHENG Wenzhong, WANG Xueying

School of Civil Engineering, Harbin Institute of Technology, Harbin 150090, China

Abstract:

In order to investigate the plastic redistribution of internal forces in encased grouted-round-steel-tube truss-prestressed concrete continuous beams, three encased grouted-round-steel-tube truss-prestressed concrete continuous beams were tested. Six simulated beams were also studied using nonlinear numerical analysis. The two ultimate limit states used for design and evaluation and the plastic redistribution of internal forces in the test beams are discussed in this paper. According to the results, the encased grouted-round-steel-tube truss-prestressed concrete continuous beams reach the limit state of the cross sectional bearing capacity when the loads begin to decrease and the displacement begin to increase rapidly on any span. The plastic redistribution of internal forces and moment modulation process mostly take place during the plastic hinge rotation at the middle support. Base on the results of the nonlinear M-analysis of cross section using strip layer method, the experimental results and the numerical analysis results, the formulae for calculating the stress increment in non-bonded tendons under the service stage and the two ultimate limit states are established. The plastic hinge lengths on both sides of the middle support under the two ultimate limit states are measured, which are used to obtain the formula for estimating the equivalent plastic hinge length by regression analysis. In addition, the formulae for computing the internal force redistribution coefficients Δ under the two ultimate limit states are proposed. For the formula corresponding to the ultimate limit state for design, the independent variables are the reinforcement indices $\beta_{o,i}$ and $\beta_{o,m}$ at the cross section at the middle support and the controlling cross section at the mid-span respectively. For the formula corresponding to the ultimate limit state for evaluation, the independent variable is the relative plastic rotation θ_p of the controlling cross-section at the middle support.

Keywords: grouted-round-steel-tube-truss unbonded prestressed concrete continuous beam static test theoretical analysis plastic hinge moment modulation

收稿日期 修回日期 网络版发布日期

DOI:

基金项目:

基金项目: 国家科技支撑计划子课题(2006BAJ03A10-07), 教育部长江学者奖励计划项目(2009-37), 教育部新世纪优秀人才支持计划项目(教课司 [2005] 290号)。

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(2210KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 灌浆圆钢管桁架
- ▶ 无粘结预应力
- ▶ 混凝土连续梁
- ▶ 静力试验
- ▶ 理论分析
- ▶ 塑性铰
- ▶ 弯矩调幅

本文作者相关文章

PubMed

通讯作者: 张博一(1979—), 男, 黑龙江哈尔滨人, 工学博士, 讲师。

作者简介:

作者Email: E-mail: boyi79@163.com

参考文献:

本刊中的类似文章

1. 郑文忠;柳旭东;张博一;.灌浆圆钢管桁架-混凝土组合梁试验研究[J]. 建筑结构学报, 2009,30(01): 15-22
 2. 赵才其1, 马军1, 靳磊2.中厚壁钢管混凝土节点抗层状撕裂试验研究[J]. 建筑结构学报, 2010,31(11): 111-118
 3. 刘.阳, 郭子雄, 刘宝成, 叶.勇.嵌埋CFRP筋组合石梁受弯性能试验研究[J]. 建筑结构学报, 2011,32(3): 75-81
-

Copyright by 建筑结构学报