

学术论文

广州新电视塔底部透空区外筒群柱面外稳定承载力试验研究

郭彦林;王永海;刘禄宇;林冰;潘汉明;梁硕;

清华大学土木工程系;广州新电视塔建设有限公司;

摘要: 广州新电视塔整体屈曲分析表明,底部透空区外筒的群柱面外失稳是结构设计中的控制因素之一。为能够准确模拟底部透空区外筒中最不利柱的受力特征,通过对3柱、5柱、7柱并联群柱模型以及底部透空区整体模型的稳定承载力分析与比较,确定以5柱并联群柱模型为试验对象。在两种不同轴力比例的加载模式下,对两榀群柱模型进行试验研究,考察最不利柱的稳定承载力、破坏模态及受力机理,探索影响群柱失稳性能的关键因素。试验结果揭示:(1)群柱的轴力分布模式对最不利柱承载力和破坏形式有重要影响;(2)群柱失稳时的相互作用(周边构件对最不利柱的约束作用)可以较大幅度地提高单柱的稳定承载力;(3)群柱失稳时环向构件的弯弓效应会强化柱受到的支撑作用;(4)广州新电视塔外筒结构依据目前斜柱和斜撑与环梁不共面的构件布置形式以及独特的节点构造设计,能够满足面外稳定承载力设计要求。

关键词: 群柱 面外失稳 模型试验 弯弓效应 稳定承载力

Experimental studies on multi-column out-plane buckling in bottom open-space region of the Guangzhou New TV Tower

GUO Yanlin1,WANG Yonghai1,LIU Luyu1,LIN Bing1,PAN Hanming1,LIANG Shuo2 (1.Department of Civil Engineering,Tsinghua University,Beijing 100084,China;2.Guangzhou New TV Tower Construction Co.Ltd,Guangzhou 510310,China)

Abstract: An overall elastic buckling analysis of the Guangzhou New TV Tower indicated the need of an experimental investigation of the interaction of multi-column buckling of outer tube in the bottom where large open space is provided.The test models with 5-column were designed to simulate the out of face buckling behavior of multi-column in open-space region part of the prototype structure.The tests of two models reveal that the multi-column buckling always occurs along radial direction of outer tube and governs the structural design of outer tube members.The axial force distribution ratio in multi-column has significant influence on the ultimate load-carrying capacity,collapse mode of the multi-column model.The interaction of multi-column buckling can greatly improve the load-carrying capacity of most disadvantageous column in multi-column model.The bowing effect of beams and diagonal bracings caused by prebuckling deformation is recognized to be beneficial for enhancing the load-carrying capacity while the multi-column buckles in out of face direction.The tests validated the design of current design for the bottom open-space region of the Guangzhou New TV Tower.

Keywords: out-plane buckling test model bowing effect of loop member stability carrying capacity

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