

世博会工程专辑

世博会城市最佳实践区C-2场馆钢结构设计要点

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摘要:

世博会城市最佳实践区C-2场馆建筑造型新颖, 结构形式独特。为体现水木相映的效果, 钢柱采用细长柱, 密布成多个圆筒, 柱顶由圆弧形主梁连接, 圆筒间次梁十字交叉布置。由于采用细长柱, 为有效减小结构自重, 楼面和屋面分别采用钢板楼面和亚克力面板。圆弧主梁受扭较大, 通过理论分析, 推导了箱形梁抗扭设计的实用公式, 并采用有限元分析方法进行了验证。整体模型计算分析表明: 结构自振特性与传统框架结构类似; 细长柱密布成圆筒状能起到类似筒体的作用, 但钢柱截面仍由侧向变形控制, 应力比较小, 相应的用钢量较大; 圆弧主梁和周边钢梁受扭较大, 利用推导的抗扭计算公式对结果再进行分析, 由于采用了高强度钢材, 应力比控制在较小水平, 保证了结构的安全性。此外, 还介绍了重要节点的处理方式和亚克力材料的结构性能。

关键词: 细长柱 圆弧梁 亚克力 扭转 长细比 层间位移角

Research on steel structure design points of C-2 Building in Urban Best Practice Area of the World Expo 2010

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Abstract:

The C-2 Building in the Urban Best Practice Area of the World Expo 2010 has novel architectural form and a unique structural style. For reflecting the harmony of the wood and water, slender steel columns are arranged into several cylinders, capitals are connected by arc main beams, and sub-beams are cross-arranged between the cylinders. In order to effectively reduce the structural weight for the use of slender columns, steel plates and acrylic panels are used for the floor and roof. Because arc beams undertake large torsion, practical design formulas of box beams under torsion are derived from theoretical analysis and are verified by using finite element method. Analysis on the whole model shows that the structural vibration characteristics are similar to the case of traditional frame structures. Slender columns arranged into cylinders can play similar role of the tube, but the steel column sections are still under control of lateral deformation with relatively small stress ratios however relatively large amount of steel. The arc main beams and surrounding beams undertake larger torsion. The results are re-analyzed by using the derived formula of torsion, and the stress ratios are controlled to small values and structural safety is guaranteed due to the adoption of high-strength steel. In addition, detailing of important nodes and structural performance of acrylic materials are introduced.

Keywords: slender column circular beam acrylic torsion slenderness ratio inter-story drift ratio

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