工程实践

新广州站内凹式索拱结构模型静力试验研究

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摘要：

新广州站站房屋盖采用一种新型预应力索拱-内凹式索拱结构，为了解该种结构的张拉成形过程、典型荷载工况下结构性能和结构极限承载力及破坏位置，分张拉成形、4种荷载工况的加载及2种典型荷载工况的极限加载3个阶段，对2榀内凹式索拱的1/3缩尺模型进行了静力试验，并将试验结果与有限元结果进行对比，有限元结果和试验值吻合较好。研究结果表明：张拉成形后索力和位形基本达到目标，确立的张拉原则可行，给出了快速确定初始张拉力的计算公式；设计工况下结构处于线弹性阶段，满跨分布荷载时主拱全截面受压，以受轴压力为主，而半跨分布荷载时以受弯为主，弯曲应力在主拱应力中的比重较大；半跨分布荷载对结构整体稳定最不利，其极限承载力较满跨分布荷载降低较大，前者在主拱弯矩最大的位置破坏，而后者在轴压力最大的拱脚附近破坏；索夹的连接形式及支座的抗推刚度对结构的承载能力影响很大。 图13表4参10

关键词： 内凹式索拱　静力试验　整体稳定　极限承载力　破坏形态

Static experimental study on model of inner concave cable arch structure for the New Guangzhou Railway Station

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Abstract:

A new type of prestressed cable arch-inner concave cable arch structure is applied in the roofs of the New Guangzhou Railway Station. In order to understand configuration erection by tensioning cables, performance under load cases, ultimate loading capacity and failure position of this structure, two 1/3 scale models were tested in three phases of configuration erection by tensioning cables，applications of four load cases and ultimate load tests by two typical load cases. Experimental results were compared with those of the FEM analysis. The results show that the theoretic value and the experimental value match well, and the cable tensile force reaches target value basically after formation erection. A formula for the determination of the initial tensile force is proposed. The models under design load cases are in linear elastic stages. The forced state of the arch under full span load cases is dominated by axial compression, while that of the arch subjected to half span load cases is controlled by moment. The half span load case is identified as the worst for over stability with the least ultimate loading capacity. Failure under half span load case occur in maximum moment while failure under full span load case occur near the foot of arch where axial compression forces are the largest. The connection form of cable clamp and the bearing stiffness of the support have a great influence on structural bearing capacity.

Keywords: inner concave cable arch　static experiment　overall stability　ultimate bearing capacity failure mode

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