

学术论文

南京长江四桥北锚碇沉井下沉安全监控研究

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摘要:

南京长江四桥北锚碇沉井长69m, 宽58m, 高52.8m, 是目前世界上平面尺寸最大的超大型沉井。因其施工难度大, 故对该沉井排水下沉过程进行安全监控。超大型沉井结构受力的最不利工况是下沉初期即开挖形成仅刃脚支撑的大锅底, 有限元分析表明, 此时顺桥向和横桥向拉应力最大点均出现在首节钢壳沉井隔墙中跨底部。根据有限元分析结果选取典型截面来监控拉应力变化。沉井下沉曲线表现出慢-快-慢的特点, 拉应力曲线则分为上升-峰值-下降-回弹4个阶段。沉井下沉初期, 随着开挖面的扩大, 隔墙底部所受拉应力也相应增加; 下沉中期, 通过调整开挖方案能有效降低拉应力, 改善结构受力状况; 当下沉超过一定深度后, 井壁外逐渐增大的土压力会使墙底拉应力减小, 结构本体趋于安全; 排水下沉到位后的地下水回灌能引起墙底拉应力增大。现场监控表明首节钢壳沉井在下沉过程中有较多的安全储备, 监控结果反馈于施工指导保证了下沉的安全高效。

关键词: 超大型沉井 排水下沉 开挖方案 地下水回灌 钢壳沉井

Sinking safety monitoring research on north anchorage caisson of the Forth Nanjing Yangtze-River Bridge

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Abstract:

The north anchorage caisson of the Forth Nanjing Yangtze-River Bridge is 69m long, 58m wide and 52.8m high. It is the biggest super-large caisson in the world. During dewater-sinking process, the structural safety monitoring research was carried out. The unfavorable loading case appears at the beginning of sinking when the soil under cross wall is excavated, and the caisson is supported only with cutting edge. According to the finite element analysis results, the maximum tensile stress along and across bridge directions appears in the mid span of the cross wall. Strain gauges were installed to monitor changes of tensile stress at key sections of the cross wall. The caisson sinking curve showed a slow-quick-slow characteristic. The tensile stress curve could be divided into 4 stages of rise-peak-descend-rebounding. At early stage of the sinking process, the tensile stress at the bottom of the cross wall increased when the excavation area expanded. At middle period of the sinking, the tensile stress decreased as the excavation plan adjusted accordingly. When the caisson sunk under certain depth, the continuous increasing soil pressure outside the sidewall made the tensile stress reduced. Ground water recharge after dewater-sinking made the tensile stress increase slightly. Field monitoring results showed that the steel skin plate caisson was safe enough during the dewater-sinking process, and the feedback of monitoring results played an important role in the safe and efficient sinking of the super-large caisson.

Keywords: super-large caisson dewater-sinking excavation plan ground water recharge steel skin plate caisson

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