

静压桩沉桩施工对临近隧道的影响

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Influences of Driving Pile on Neighboring Tunnel

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摘要 基于圆孔扩张理论运用FLAC^{3D}有限差分软件模拟了静压桩沉桩挤土过程,并对土体位移的数值模拟结果与解析解计算结果进行了对比,二者的计算数值与变化趋势吻合得较好.在此基础上,运用位移贯入法模拟沉桩的摩擦作用,使沉桩全过程的计算结果更趋近于实际情况.基于此数值模拟方法分别计算沉桩深度为4, 8, 12, 16, 20 m的沉桩行为对临近隧道的变形与内力影响,得出了以下结论:静压桩沉桩对邻近隧道的变形有较明显的影响.随着沉桩深度的增加,隧道结构位移也随之增大,且以水平位移为主.当沉桩深度达到20 m时,隧道结构最大位移为11.55 mm.沉桩过程亦使隧道产生一定的扭转:沉桩深度为4, 8, 12, 16 m时,隧道顺时针偏转(背向沉桩方向);沉桩深度为20 m时,隧道逆时针偏转(朝向沉桩方向).随着沉桩深度的增大,隧道结构的附加弯矩从对称竖向轴线分布逐渐向逆时针方向偏转至对称横向轴线分布;沉桩后隧道的弯矩图有逆时针扭转的趋势(转向沉桩侧),且大部分隧道结构的弯矩绝对值有减小趋势.

关键词: 静压桩 圆孔扩张理论 桩-土相互作用 隧道 沉桩深度

Abstract: This article begins with simulation of the static pressure pile driving process with FLAC3D based on the cavity expansion theory, and compares the results of numerical simulation and analytical calculation. The calculated values and the trends of numerical simulations and analytical solutions are consistent. Therefore, simulation of the effect of pile driving friction on the displacement penetration method helps produce results close to practice in the entire pile driven process calculation. The pile driving calculation of the resultant effects on the deformation and inner force of the nearby tunnel with depth of 4, 8, 12, 16 and 20 m draws the conclusion that static pressure pile driving has an obvious effect on the deformation of the nearby tunnels. As the depths increases, displacement of the tunnel structure increases, which mainly consists of the displacement in the horizontal direction. The maximum tunnel structure displacement reaches 11.55 mm when the pile driving depth is 20 m. Meanwhile, the pile driving process results in tunnel deflection: counterclockwise (away from the pile) deflection when the pile driving depth is 4, 8, 12 and 16 m; clockwise (toward the pile) deflection when the pile driving depth is 20 m. As the pile driving depth increases, the additional bending moment distribution of the tunnel structure changes gradually from vertically axial symmetry to laterally axial symmetry. The tunnel bending moment turns counterclockwise (toward the tunnel) after pile driving and for most tunnel structures, the absolute values of bending moment tend to decrease.

Keywords: static pressure pile, cavity expansion theory, pile-soil interaction, tunnel, the depth of pile driving

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