报告题目： **饱和软土中浅埋地铁隧道衬砌渗漏引起的沉降问题**

报告人： 郑永来
报告人单位： 同济大学水利工程系，上海

摘要： 随着大城市的发展和扩建，在建筑区的软土地基上修建多条浅埋隧道成为必然。隧道施工达到长期稳定状态后，隧道与地面的沉降是关系到地铁及近建筑物安全的重要问题之一。针对隧道衬砌的渗流问题，本报告通过采用流固耦合有限差分法和力学有限差分法，展示了上海地铁隧道在不同的隧道开挖后水流条件下的沉降。平行双圆形隧道的净间距为 7.8 m，内径为 5.5 m，外径为 6.2 m。其建造在地表以下 7 m 处，土壤条件为中国上海的土壤条件。隧道衬砌渗透性从完全渗透到不渗透，提出并评估了有限衬砌渗透性的建模方法。对于沉降分析，模拟了两种流态，一种是地下水位保持在其原始高程，另一种是地下水位朝隧道方向下降。其次，分析了水流的平衡周期，即沉降的稳定时间。最后，估算并讨论了软土长期蠕变和地下水位对沉降的影响。结果表明，上海地铁软土隧道的渗透沉降可达 22cm，接近隧道的监测沉降。

关键词： 地铁隧道，软土，渗流，蠕变，沉降，数值模拟，案例研究

Settlements Induced by Lining Seepage of Running Metro Tunnels at Shallow Depth in Saturated Soft Soils

ZHENG Yong Lai
Department of Hydraulic Engineering, Tongji University, Shanghai, P.R. China

Abstract: The development and extension of large cities creates a need for multiple shallow tunnels in the soft ground of building areas. The settlement of the tunnels and ground is one of important problems related to metro and near building safety after the tunnel construction s through to the long-term steady state. In view of seepage of tunnel lining, this talk presents the settlements of Shanghai Metro tunnels in the different post-tunneling flow conditions with coupled flow and mechanical finite difference methods. A parallel double circular tunnels with a net interval of 7.8 m, an internal diameter of 5.5 m and an external diameter of 6.2 m constructed 7m below ground surface lever are adopted for the geometry, with the soil conditions based on those found in Shanghai, China. The tunnels lining permeability is varied from fully permeable to impermeable, and an approach to modeling finite lining permeability is presented and assessed. For the settlement analyses two flow regimes are modeled, one in which the water table is maintained at its original elevation and one in which the water table is drawn down toward the tunnels. Then equilibrium periods of flow, i.e. stability time of the settlement, are analyzed. At last, the influence of long-term creep of soft soil and groundwater lever on the settlements was estimate or discussed. The results show that the seepage settlement of the Shanghai Metro tunnels in soft soil can reach to 22cm, which was near the monitoring settlement of the tunnels.

Keywords: Metro tunnel, Soft soil, Seepage, Creep, Settlement, Numerical Modeling, Case studies