



## Time-Dependent Foundation Settlement of Super High-Rise Buildings in Soft Clay Area

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### Summary

The settlement of foundation includes initial settlement, consolidation settlement and secondary consolidation settlement. By considering the mechanism of foundation settlement and the upper structural properties of time-dependent materials, time-dependent loads and time-dependent structures, the time-dependent rules of foundation settlement in soft clay are investigated in this study. Existing settlement prediction models are further developed, and a stepped loading time-dependent settlement model for the super high-rise buildings in soft clay is proposed. Numerical simulation of a super high-rise building project illustrates the effectiveness of the proposed time-dependent settlement model. The time-dependent settlement model developed in this study provides a foundation for further studies on the time-dependent effects due to the upper structure-foundation-subgrade interaction.

**Keywords:** Super high-rise buildings; foundation; time-dependent settlement; stepped loading; interaction

### 1. Introduction

The settlement of ground or foundation plays important rule in super high-rise building design, construction and operation. Especially for super high-rise buildings in soft soil area, the settlement becomes the controlling factor in foundation design. In the early 20th century, K. Terzaghi and other researchers established and further developed a classical method to analyze the foundation settlement<sup>[1]</sup>. In the 1970s, with the development of computer technology, finite element analysis method was feasible for the calculation of the foundation settlement. However, the calculation of foundation settlement has always been one of the three major problems in foundation engineering due to its high uncertainty<sup>[2]</sup>.

Generally, the settlement deformation of buildings includes initial settlement, consolidation settlement and secondary consolidation settlement, according to the order of occurrence. The nature of foundation settlement is actually time-dependent. However, most settlement calculation methods in engineering practices are based on elasticity theory, with analysis parameters summarized from engineering experiences. The elasticity theory based settlement calculation methods can only calculate the final foundation settlement, without considering the time-dependent behavior.

By considering the mechanism of foundation settlement and the upper structural properties of time-dependent materials, time-dependent loads and time-dependent structures, the time-dependent nature of foundation settlement in soft clay are investigated in this paper. Existing settlement prediction models are further developed, and a new time-dependent foundation settlement model in