Field Monitoring and Parameter Identification of Moisture Distribution for Mega Steel Reinforced Concrete Columns

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Summary

Mega steel reinforced concrete columns with complex embedded steels become widely applied in the structural system of contemporary super-tall buildings. The moisture distribution of concrete has significant influence on the deformation performance of mega steel reinforced concrete columns. However, the effects of the differential moisture distribution on the deformation performance of mega steel reinforced concrete columns are actually not considered in current design practice of mega SRC columns. The moisture distribution of concrete has been analyzed using numerical simulation in the author's previous studies. In order to verify the numerical analysis results, a moisture distribution monitoring program of Shanghai Tower columns was applied to obtain the actual moisture distribution of mega SRC columns. The monitoring data and simulation data have been compared in this paper and the moisture diffusion coefficients were further calibrated by parameter identification procedure. The comparing results indicate that, the moisture simulation data obtained using the identified moisture diffusion coefficient are much closer to the recorded date and can be applied for further study on the moisture distribution.

Keywords: super-tall buildings; mega columns; complex embedded steels; differential moisture distribution; moisture distribution monitoring; moisture diffusion coefficient; parameter identification.

1 Introduction

Super-tall buildings have been developed rapidly due to the rapid development of world economy, application of new materials and progress in design theory. Composite structure has been widely applied in the structural system of super-tall buildings [1].

Creep and shrinkage of concrete produces long-term deformations that cause shortening of vertical structural members in super-tall buildings [2]. For vertical structural members, this effect may lead to undesirable problems related to serviceability and structural safety. In particular, differential vertical deformation between vertical structural members may be induced by different loads applied and differences in sectional capacities for loading [3].Vertical deformation difference caused by shrinkage and creep will increase continuously with the increasing of the super-tall building height and the deformation difference will reach the maximum at the top floor due to the cumulative effect [4].

With the rapid increase of super-tall building construction in recent years, mega SRC columns have come into wider use, due to their higher sectional efficiency than that of RC columns. However, the latest experimental study [5] has shown that mega SRC columns shortening tend to be overestimated

https://doi.org/10.2749/222137814814027954