

Static analysis of high-rise concrete buildings with Holistic 3D models

Thomas Markus Laggner, Dirk Schlicke, Nguyen Viet Tue

Institute of Structural Concrete, Graz University of Technology, Austria

Contact: thomas.laggner@tugraz.at

Abstract

Holistic 3D calculation models have become an indispensable part of the structural analysis of complex and/or unconventional structures. The determined load distribution within the structure and the particular stressing of the members are hereby strongly depending on the modelling approaches. This contribution shows the effects of different modelling approaches by a systematic investigation of a representative high-rise reinforced concrete building with flat slabs and a core for the structural stability. In principal, the difference between the conventional method using extracted 2D sub models and a linear-elastic holistic 3D model is shown. Following, the effect of the regarded connection stiffness between the structural elements, the significance of a construction stage analysis (CSA) and the influences of creep and shrinkage of the concrete on the load distribution are presented in detail. It was found that all parameters as well as their interplay have clear influences on the determined stressing and should be addressed accordingly.

Keywords: structural analysis; holistic 3D model; construction stage analysis; creep; shrinkage

1 Introduction

3D calculation models become more and more standard practice in structural design of building constructions (like one is shown in Figure 1). The reasons are the increasing digitalisation of the planning process in general and the particular optimization potential in the dimensioning of individual structural elements since the interaction between the horizontal and vertical bracing systems can be simulated more realistically. Moreover, holistic modelling approaches considering construction stages, soil-structure interactions, time-dependent effects of concrete and redistribution of stresses due to cracking can lead to a quality jump in the prediction and the assessment of the actual structural behaviour of buildings. The possible potential of a more accurate description of the load distribution with holistic 3D models has been outlined in [1], [2], [3], [4], [5], [6].

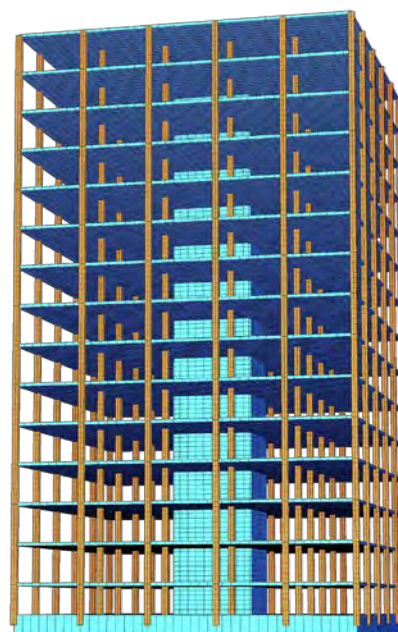


Figure 1. holistic 3D calculation model of the representative high-rise building