Sustainable design of office buildings in steel composite construction

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Summary

The issue of sustainability becomes more and more important in the building industry. Within the scope of the German FOSTA research project P881 "Sustainable office buildings in steel composite construction" [1] recommendations and planning tools for slabs and columns in consideration of structural and technical as well as economic and ecological requirements were developed. In this paper, firstly, the requirement profiles of ceiling systems and columns are demonstrated. Deepened discussed are the possibilities of an environmentally compliant design for structural components, which includes optimisations of static, ecological and economical aspects. For the purpose of reuse and considering deconstruction a systematisation of structural components as well as the environmentally compliant design are implemented. Furthermore, concepts for the increase of resource efficiency are demonstrated.

Keywords: sustainability, office buildings, steel composite construction, life cycle assessment

1 Introduction

The demographic change and the growing awareness of sustainability are examples of changing social conditions, which affect the user requirements of office buildings. Resource conservation, recyclability, life cycle costs and conservation of value, even under changing property conditions, are increasingly the focus of planning. From the very first, the structural system of the building is of great importance. Column positions and stiffening walls determine the spatial possibilities and allow different flexibility of the floor layout, or restrict it. Besides their static function, the structural system often adopts other functions. For example, it serves as a mass accumulator in order to generate a more comfortable climate. Based on the requirements and the pre-setting of the building and its structural design, media lines for air conditioning as well as electricity, telecommunications and water supplies are integrated into the building design and the necessary adjustments are conducted [1], [2].

2 Floor systems

For office buildings steel-concrete composite structures are used in many technologically highly-developed countries, particularly in inner city areas. Advantages of this construction type are, amongst others, the high degree of prefabrication, the low-weight construction conditions, the rational economic construction and the extensive independence of the weather conditions. According to the structural design of the floor systems, there is a distinction of two basic design principles: floor systems with downstand beams as composite beams and slim-floor-systems with integrated floor beams (Fig. 1). At low to medium spans (grid up to ca. 11 x 8 m), the use of slim floors with integrated steel beams is possible. Advantages of this construction type are low construction heights and installation freedom. This has a positive effect on the floor-to-floor heights and thus also on the facades and the volume of the building that has to be heated. For larger spans downstand beams are suitable, which allow a free floor layout. Common lengths for secondary

https://doi.org/10.2749/222137814814069976