Slab with integrated installations

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Summary

A new slab system was developed which allows large and easily accessible installations. This goal was achieved by integrating the building services into the slab structure instead of a suspended ceiling or false floor. The load carrying structure consists of a thin concrete slab connected to girders on the upper side. The girders are produced with large openings acting as ducts for the installations. Removable plates establish the floor on top of the girders. Therefore the installations are easily accessible. Since the installation is integrated into the slab structure the load carrying structure can be higher than in conventional floor systems, while the overall height is still lower. The increased structural height allows for larger spans.

Keywords: slabs; high-rise buildings; installations, concrete structures

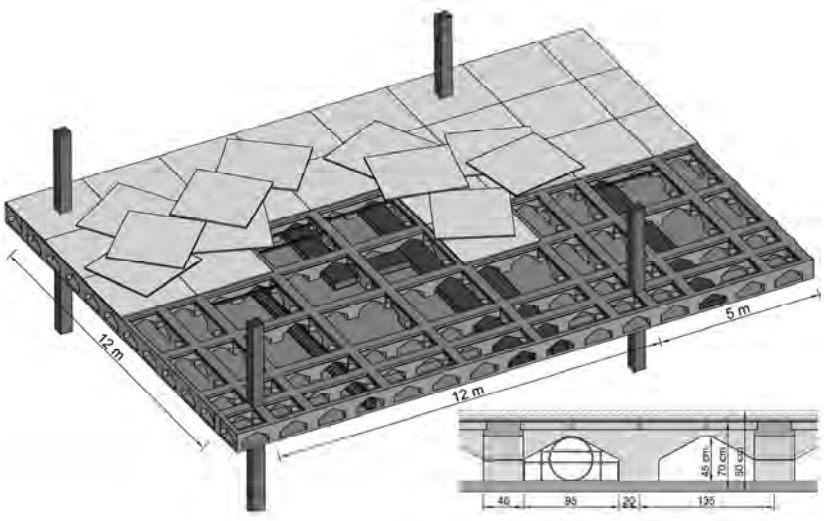

Fig. 1: Slab for installations – the idea

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Fig. 2: Structure of the slab with integrated installations

Construction

The slab with integrated installations consists of a thin reinforced concrete slab with a thickness of 10 cm. The thickness guarantees the structural fire protection and is independent of the span. Therefore the self weight of the structure is almost independent from the span. The girders are placed on the upper side of the slab and generate a framework. This framework consists of a continuous top chord with a height of 15 cm and a system of compression and tension struts which allow large openings for the installations. The girders are arranged biaxially and their distance to each other is variable between 1.25 – 2.50 m, depending on the external load. In order to complete the floor, plates are positioned on top of the chords which can easily be removed. Thus the installation ducts are accessible during the whole service life of the building, without destroying the flooring system.

Fields of application

Due to the large construction height, the low dead load of approximately 500 kg/m² and the biaxial arrangement of the girders, the new slab system is perfectly suitable for large point supported slabs. With a construction height of 45 - 90 cm spans of 8 x 8 m till 16 x 16 m can be reached. This considerable construction height can be used for 30 – 65 cm high installation ducts.

Experiments

Large scale tests on slab strips were performed in the laboratory. The specimens used were continuous beams on 3 column supports with a total length of 16.8m, a width of 2.4m and a height of 0.5m in order to provide space for 0.3m high service lines. With ten hydraulic jacks the load of a column supported slab system could be simulated. Results from the destructive load tests demonstrated the superior load carrying behaviour of the new slab system.

Conclusions

The slab with integrated installations shows that the low self weight and the considerable construction height allows for spans up to 16 m. Due to the usage of prefabricated elements a fast and easy construction on site is possible. These prefabricated elements have a high stiffness and can therefore be positioned without additional supports. Since the geometries of the single elements can be adjusted, this slab system is applicable to complex slab geometries. Another important advantage of the concrete slab with integrated installations is the flexible utilization of the installation space during the life time of the building.