

The effect of different types of column and slab concrete on load carrying capacity of the monolithic column – slab connections

SUMMARY

The scope of the dissertation concerns the problem of load carrying capacity of reinforced concrete columns in the connection zone with lower strength concrete slabs. Even though this issue is encountered in design practice, it was not included yet in any existing European code provisions. The principles of international standards are based mostly on the results of the historical experimental investigations, and in many cases describe improperly the characteristics of concrete used these days.

Considering the state of knowledge the issues were stated, which were not the subject of previous experimental studies. The own experimental program was formulated to explain the effect on load carrying capacity of high strength concrete columns intersected by weaker concrete slabs such factors as type of slab concrete (normal or lightweight aggregate) and geometry of the connection (inner, edge or corner – taking into account the location of the column respect to slab edge).

The experimental program consisted in a total of nine specimens, which represented high strength concrete columns intersected by slab made of lower strength concrete. The testing method enabled to reflect the actual work conditions of real structures. Besides basic elements, comparison models which were columns made entirely of high strength concrete were also tested. Their load carrying capacity was a benchmark by evaluating the effect of intersection on load carrying capacity of columns of basic specimens.

During the tests strains of slab and column reinforcement were recorded. The strains on column surfaces were also measured. The cracks on the column and slab surfaces were inventoried. These results are presented in the Annex to dissertation. Analyzing the results of the investigations and considering the failure mode of the specimens, the most meaningful factors which affect the load carrying capacity of columns intersected by weaker slab concrete were specified. These were such parameters as: effective mechanical reinforcing ratio (which reflect the actual load carrying capacity exhaustion of slab longitudinal reinforcement due to bending), relation between column and slab concrete modules of elasticity, geometry of column – slab connection joint as well as column to slab concrete strength aspect ratio.

Taking into account the results of experimental investigations the aforementioned parameters in terms of quality and quantity were assessed. On this basis the relationships were formulated, which allow to determine the effective strength of joint concrete of basic type of column – slab connections. Good agreement of the proposed analytical equations with results of own and other experimental investigations was achieved. They have been used by developing the design concept, which could be applied in the analysis of engineering problems. In the dissertation examples, which explain how to conduct the calculations in the design practice, were also presented.

Michał Góldyn