Strengthening of the Transfer Floor of Berlin's Steglitzer Kreisel

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Abstract

The Steglitzer Kreisel is an office building complex located in Berlin which was erected in the 1970s. The main element of this complex is a 30-story high-rise building that stands 120 meters above the ground and is currently the third tallest building in Berlin. Due to the architectural requirement for a diaphanous atrium, the level above it was originally designed as a transfer floor in order to accommodate the discontinuity of the vertical columns. This level consists of 4.8-meter-high built-up steel beams, which provide support for the closely spaced columns of the upper levels and transfer their loads into the atrium mega-columns on which these beams rest.

The renovation project this building has undergone has had as its purpose the change of use into a residential building, so that new elements, such as balconies and bay windows, were added to the existing structure. As a result, there was a variation in the reaction forces of the columns over the transfer floor. Although there was no increase in the loads transmitted to the atrium columns and therefore to the foundation, the transfer beams had to be analyzed and partially strengthened, since their state stress suffered a modification from the original state.

This paper presents the methodology employed to evaluate and strengthen the transfer beams. Firstly, the failure modes are identified and classified into plate buckling and excessive yielding and the FEM models and code-based calculations are presented. Secondly, the reinforcement of the critical areas through the addition of both stiffeners and welded steel plates - according to the failure mode - is discussed. Finally, the execution process and its multiple constraints are described.

To conclude, this approach has been proven to be an innovative and economical solution to a real-world complex engineering problem. The capacity of the existing structure is fully made use of and the execution process affects neither the remaining construction works nor the existing installations. Furthermore, this methodology can also be used to evaluate a wide range of existing plate- and shell-like steel structures.

Figure 1: Building under construction in 1971 and erection of the transfer beams painted in yellow.

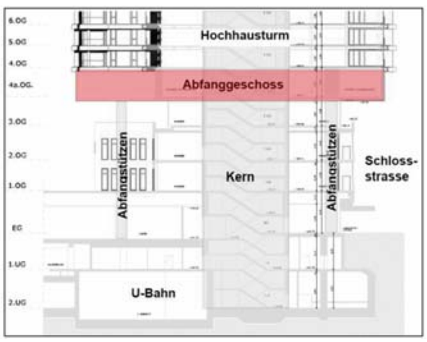

Figure 2: Building section with the transfer floor marked in red.

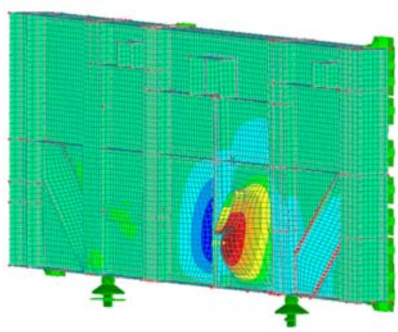

Figure 3: FEM model of one transfer beam. A nonlinear stability analysis was implemented in order to evaluate plate buckling.