

Robustness of Structures Constructed with Industrialized Reinforced Concrete Walls

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ABSTRACT

The need for high-rise buildings in Israel grows fast in order to satisfy the increasing demand for housing, especially for young couples, as well as aiming less complicated implementation process because of the shortage of experienced workers. In addition, the authorities in the country require external cover for walls, usually made of natural stone, in order to maintain proper architectural appearance and durability. Outer coating was carried out, over the years, at a later stage after the completion of the skeleton structure. The former mentioned resulted in a new construction method, commonly used in recent years in Israel, entitled Baranovich Method. In this industrialized procedure, the coating is carried out as part of reinforced concrete walls, which exist in the external perimeter of the structure, at the same stage. In this method, the common slabs are flat plates (slabs without beams).

Partial fixity occurs along the edge of a slab and the external wall; however, it is usually not taken into account in the analysis. Therefore, reinforced concrete codes of practice require top reinforcement along the slab-wall boundary to be capable of resisting at least 15% - 25% of the maximum moment in the adjacent span. The external perimeter walls of the building guarantee a great rigidity and robustness to the structure, yet the weak point is the interior columns. In a residential apartment there are, usually, one or two internal columns that receive a large part of the slab loads. The aim of this work is to ensure robustness of the structure and to facilitate alternative static scheme and alternative load paths development by allowing loads to be transferred to the external industrialized reinforced concrete walls, in case of interior column removal in the building as a result of an unusual accident, through the utilization of outer shell restraints at ultimate limit state. In addition aiming to avoid a chain collapse of the entire structure or significant part of it. The proposed procedure will examine the current standards slab-wall boundary reinforcement requirements and will give recommendations for buildings constructed using the Baranovich Method. Moreover, the present study will result in recommendations for the top and bottom reinforcement amounts required at the internal columns. The purpose of this article is to ensure robustness and stability of the structure after an interior support removal. Partial factors for actions and materials should be lower than those required at ultimate limit state. Alternative static scheme will contain full fixity to the external walls and be based on maximum redistribution to increase negative moments over the fixing walls, and decreasing positive moments in the spans (unlike the general practice), taking advantage of existing reinforcement at spans. This approach may be adopted later in the design of flat plates in residential apartment buildings, in cases where eliminating internal columns are more architecturally-sound and comfortable to occupants use throughout the life of the building.

References

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