

Theoretical Evaluation on Effects of Opening on Ultimate Load-carrying Capacity of Square Slabs

Chee Khoon Ng
Timothy Julius Edward
Daniel Kim Tee Lee

Universiti Malaysia Sarawak, Malaysia

ABSTRACT

Reinforced concrete slabs are the most common structural elements found in building construction. Despite the large number of slabs designed and built, the details of the elastic and plastic behaviour of slabs are not always appreciated or taken into account. Studies on slabs with openings are also scarce in the research on reinforced concrete elements. Therefore, a study on simply-supported and fixed-end, square slabs with opening at ultimate limit state using the yield line method was carried out and the results are presented herein. For simply-supported slabs, the analytical study on the ultimate load capacity of the slab shows that the ultimate total load decreases with the size of the opening. However, when the ultimate total load is converted to ultimate area load, the results show otherwise. In the study of fixed-end slabs, the results show that the opening has insignificant effect on the ultimate area load capacity for a small opening size of up to 0.3 times the slab dimension. For opening size of more than 0.5 times the slab dimension, the ultimate area load capacity increases drastically. The ultimate total load of a fixed-end slab with opening up to 0.3 times the slab dimension is also not affected by the opening. However, the ultimate total load increases drastically for opening size of 0.5 times or more of the slab dimension. All the results in this study are plotted in nomographs form and can be used as guidelines for the design of slabs with opening particularly in determining the ultimate load capacity.
