Design of lightweight concrete slabs under two-way shear without shear reinforcements: a comparative study and a new model

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Abstract

Developing design models that are accurate compared to experimentally measured strength, yet physically sound, continues to be the ultimate research goal. For this purpose, the two-way shear design provisions of the American design codes have been updated. While that of the European design codes are being investigated. The two-way shear failure of slabs is a sudden one, which can be catastrophic. In addition, lightweight concrete (LWC) is gaining a lot of attention due to its economic advantage, however, very limited studies focus on investigating LWC slabs under two-way shear loading. The purpose of this study is to examine existing design codes and ongoing proposals for the case of LWC slabs under two-way shear. A comprehensive literature review of the available two-way shear testing for LWC slabs was conducted. An extensive database with a total of 129 tested LWC slabs was compiled. Selected design codes were used to calculate the two-way shear strength of the tested slabs. The Strength ratio (SR) was compared for selected codes, which is calculated as the ratio between the experimentally measured strength and that calculated using different design codes. In addition, the effect of various parameters on the SR was assessed. Concluding remarks were outlined and discussed. Moreover, a design formula for LWC slabs under two-way shear, which is physically sound and simple was developed and validated using experimental results. It was found to be more accurate, and more consistent compared to existing design codes with regard to experimentally measured strength. It is worth noting, that the investigated draft of the Eurocode is not final. However, these findings could help develop future design provisions for two-way shear of LWC slabs, which have to be physically sound, more consistent, and more accurate compared to existing one.

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