Title: Multi-level assessment of a full-scale tested bridge deck slab

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Reinforced concrete slabs without shear reinforcement are commonly used in many structural systems, such as bridge deck slabs. Punching/shear is usually the governing failure mode at ultimate of those RC slabs subjected to concentrated load. However, previous study has shown that existing models are too conservative. Thus, the aim of this study is to evaluate and improve the existing calculation model.

In this study, a "Multi-level Assessment Strategy" has been applied to a 55-year old existing reinforced concrete bridge deck slab with concentrated load near the girder. The punching/shear strength was calculated based building codes, Critical Shear Crack Theory and Nonlinear FE analyses. The difference between assessment methods at different levels has been discussed regarding punching and one-way shear behavior of slabs. In addition, a full-scale test was carried out to to the bridge to calibrate the calculation model. Furthermore, the failure mode between one-way shear and punching was discussed. The influence of boundary condition, location of concentrated loading and arch action were investigated in the model. The shear force distribution was analyzed in different cases to evaluate the influences to the failure mode. The choice of effective to calculate the one-way shear resistance was discussed based on shear force distribution.

Results show that the failure mode to the slab was between punching and one-way shear. Shear force distribution is influence by cracking and the failure mode would be affected by factors such as boundary condition and location of concentrated loading.