Research Paper Award

Relationship between Shear Force and Slip of Reinforcing Bar in a Joint Interface of Half Precast RC Structure

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This paper proposes a method for calculating the shear-force versus displacement relationship for the joint plane of half-precast RC structures, in which precast concrete and cast-in-place concrete act together to resist external forces. The work is based on an experimentally developed mechanical model for the shear behavior of steel bars across the joint plane, which is commonly called dowel action. Further, based on this new calculation method, a simple macro formula for predicting shear capacity, yield stress, and residual displacement is proposed.

Based on the assumption that the model is applicable to joint failure in the overall evaluation of the behavior of a structure, it is applied up joint rebar rupture. It is a simple model constructed based on the original assumption that the deformed shape of the rebar itself is a circular arc based on the properties at the time of rupture.

This new model combines previous mechanical models, such as a rebar extraction model based on the adhesion mechanism, and considers the forces perpendicular to the joint plane and the opening of the joint plane with respect to the shear behavior. The simplicity of the model and its mechanical basis mean it has the versatility to enable, in future, the evaluation of the shear behavior of joint surfaces under applied multi-directional forces. Although the scope of model application is limited within the scope of the experiment, the variables used in the macro formula are few and easy to introduce into finite element analysis, making it a highly practical approach.

With the use of precast concrete in construction work increasing as productivity improvements are sought, this research topic is clear and timely. The novelty and completeness of the research are noted. For these reasons, the paper was judged to be worthy of the Research Paper Award.