Experimental and Numerical Investigation of the FRP Shear Mechanism for Concrete Sandwich Panels - DTU Orbit (18/10/2019)

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This paper investigates the composite action of 46 segments representing precast concrete sandwich panels (PCSPs) using a fiber-reinforced polymer [FRP; specifically, a carbon fiber-reinforced polymer (CFRP)] grid/rigid foam as a shear mechanism. The experimental aspect of the research reported in this paper examined the effect of various parameters believed to affect the shear flow strength for this CFRP grid/foam system. The parameters that were considered are the spacing between vertical lines of CFRP grids and the thickness of the rigid foam. Results of the experimental aspect of the research reported in this paper indicated that increasing the spacing between vertical lines of CFRP grid increases the overall shear flow strengths due to the increase of the bonded contact area of the rigid foam to the concrete surface. However, the overall shear stresses were decreased due to the increase of this interface surface area. Test results also indicated that increasing the rigid foam thickness decreases the overall shear flow strength when compared with the same quantity of CFRP grid spacing. A nonlinear three-dimensional (3D) FEM analysis was performed to model the behavior of the tested segments and to study the behavior of PCSPs. Results of FEM analysis were in good agreement with the experimental results. A design equation was developed to determine the shear flow strengths for the given CFRP grid/foam systems. The parametric study of the research reported in this paper was performed to predict shear flow strength of different FRP materials, rigid foam thickness, and spacing between vertical lines of the grid.

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