Fiber Reinforced Polymer, FRP material has been accepted as an alternative construction material for several civil engineering applications. This paper presents the use of FRP material for the precast industry and more specifically Concrete Sandwich Panels typically used as bearing wall panels and building envelopes of many structures. The research examine the use of a carbon fiber reinforced polymer (CFRP) material, configured as a grid and placed in composite action with rigid foam insulation, as the main shear transfer mechanism for precast concrete sandwich panels. The motivation for the use of these materials is in their ability to provide composite action between the two concrete wythes, allowing for greater structural capacity, higher thermal efficiency, and a longer service life. The research program investigated the effect of several parameters believed to affect the shear flow strength of the CGRID/foam insulation material mechanism, including the type of rigid insulating foam, the spacing between rows of CFRP grids, and the thickness of the foam insulation. A comprehensive experimental program was conducted to determine the characteristics of the shear transfer mechanism of the grid/insulation. Test results are used to develop an equation to estimate the shear flow strength using the CFRP grid/rigid foam as affected by these parameters.

A non-linear 3-D finite element program was used to model the behavior of the test specimens and to study the behavior under several other parameters is presented. A solid element with different crushing and cracking characteristics are selected to model the concrete and the rigid foam materials. Contact elements are used by means of Coulomb Friction theory to model the shear transfer mechanism at the interface between the different layers. Rupture and buckling behavior of CGRID was simulated by Damage Evolution technique using link elements. The ultimate strength and the degree of composite action were found to depend on the combined action of the bond between CGRID/Rigid foam and concrete.

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