Abstract

Mostafa Y Yossef

Effective width of insulated sandwich panels with interior flexible FRP shear connectors considering partial degree of composite action

Insulated sandwich panels consist of two layers of wythe separated by a foam insulation. In recent years, fiber-reinforced polymer (FRP) materials have begun to be incorporated as shear connectors, because they have a lower thermal conductivity than steel and can significantly reduce thermal bridging. Until now, no effective guidelines exist for the design of these panels. Generally, they are treated as rectangular beams, which is not reasonable because the longitudinal stress over the wythe section is nonuniform resulting from the in-plane shear flexibility of the wythe, which is called the shear lag effect. The effective flange width has been used to describe the shear lag effect for a deck-on-girder composite beam system, reducing a three-dimensional behavior of the composite beam system to the analysis of a T-beam section with a reduced width of deck. This paper extends the concept of effective flange width to insulated concrete sandwich panels. A shear lag model is first developed to study the sandwich panel system, in which partial degree of composite action (DCA) owing to a flexible FRP shear connector is considered. The analytical model is then verified through close correlations between finite-element and analytical results for a concrete sandwich panel with FRP shear connectors. Finally, a parametric study was conducted using the analytical model.