Abstract

Mostafa Y Yossef

A solution considering partial degree of composite action for insulated sandwich panels with general configuration flexible shear connectors

Insulated sandwich panels consist of two wythes separated by a non-structural insulation layer. These two wythes are connected using shear connectors. In recent years, Fiber-Reinforced Polymer (FRP) shear connectors have been increasingly used due to their low thermal conductivity. However, they have lower stiffness compared to other rigid shear connectors, resulting in partial degree of composite action (DCA) for the sandwich panels. Until now, insulated sandwich panels are designed based on the assumption that the longitudinal stress is uniform across the wythe, which is not reasonable since the in-plane shear flexibility of the wythe causes non-uniform distributions of the stress, which is called shear lag effect. This paper presents an analytical solution to study the behavior of insulated sandwich panels with flexible shear connectors. To this end, a solution based on the shear lag model is firstly developed, where the partial DCA and boundary conditions from various configurations of the flexible shear connectors are considered. The effective width, an important parameter to describe the shear lag effect, is defined. The analytical model is then verified through close correlations among experimental, Finite Element (FE) and analytical results for multi-cell box girders and FE and analytical results for an insulated concrete sandwich panel with FRP shear connectors. A parametric study is finally conducted using the analytical model to study the effects of deck stiffness and aspect ratio on the effective width. The results from this study can be used for the design of insulated sandwich panels.