

SINGLE-SIDED WELDED CONNECTIONS FOR STEEL-PLATE COMPOSITE (SC) MEMBERS

Steel-plate composite (SC) members are a high strength and ductility solution for a range of structural applications, including nuclear power, blast design, and seismic resistance for high-rise buildings. Their composition is characterized by concrete infill between confining steel plates and shear connectors to achieve composite action. Compared to traditional reinforced concrete, SC systems provide enhanced capacity, and the use of prefabricated modules significantly decreases field construction time. A challenge introduced by these systems is welded connections where access is only possible from one side of a member. Limited access can particularly be a factor when small section depths are involved or for module-to-module connections in nuclear reactor basemats. Though fillet welds are often the simplest and most resource efficient option from a quality inspection perspective in high demand applications, research on single-sided fillet welded connections is limited. This is because guidance in the ANSI/AISC 360-22 Specification for Structural Steel Buildings discourages such connections due to their inherent eccentricity which induces moment that acts to open the joint. This study investigated the capacity of two different partial access connections, using a standard full access lap-splice double-fillet weld detail as a control. The experimental behavior of each transverse weld connection was examined via tensile testing. Then finite element analysis models were developed, incorporating measured weld geometry and features to predict the experimental capacity of the connections. The finite element models provided accurate predictions of the connection capacity and failure mode seen experimentally, and the connections were found to exhibit significantly greater capacity than suggested by nominal design calculations.