Advances in and Benefits of Rapid Steel Connections

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Abstract

Pairing of robotic arms with precision cutting in the form of laser, plasma, and water jet cutting has opened the door to entirely new forms of structural steel connections that can be assembled with no field welding and minimal (if any) bolting. Such connections can offer increased erection speed, decreased safety issues, and in some cases the opportunity for rapid disassembly, thereby creating a pathway for direct reuse. This paper provides an overview on the testing, numerical modeling, and field assembly of one such connection – the Intermeshed Steel Connection (ISC). This paper highlights features and behaviors of this connection when simulated, tested, and erected in a beam-to-beam connection and focuses on compliance, ability to be designed reliably, load transfer between the side plates and the main member, and the relatively rapid speed of erection compared to a traditional fully bolted connection. Because of its limited number of pieces, the connection may enable in-situ robotic assembly.

Keywords: steel connections; digital manufacturing; steel fabrication; steel erection; quick steel connections; design for disassembly; robotic assembly.

1 Introduction

Steel structures are assembled from many small parts connected together to create the final configuration. Part sizes are usually maximized to the extent possible within manufacturing, transportation, and erection limitations. Those limits result in the need for many connection pieces. Steel connections have been a major factor in the design, costing, and construction of the structural steel industry, since its earliest day of its mass production in the 19th century [1] Currently most