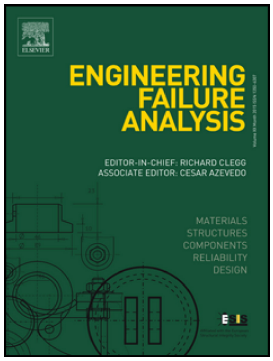

Experimental investigations on monotonic and cyclic behavior of steel pallet rack connections

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Experimental investigations on monotonic and cyclic behavior of steel pallet rack connections

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Abstract

Application of steel pallet racks (SPRs) for storage purposes has been widely grown around the world since the age of the industrial revolution. SPRs are cold formed structures and beam-to-column connections (BCCs) used in these structures are largely responsible for the sway stability of these frames in the down-aisle direction. It is essential to understand the performance of SPR BCCs under variable circumstances. This study investigates the monotonic and cyclic behavior of SPR BCCs. The cantilever test method was used and six monotonic and six cyclic tests were conducted according to the European standard and major failure modes and moment-rotation (M-θ) behavior of the connections were identified. In order to appraise the influence of parameters, the connections were distinguished by column thickness. After investigating the original rotational stiffness value, moment resistance, ductility and failure mode of the connection, an innovative design of SPR BCC is proposed with one additional bolt in the beam end connector and monotonic testing was performed. The findings showed that the proposed connections increased the performance of SPR BCC to a larger extent.

Keywords: Steel pallet racks; Beam to column connection; Cantilever testing; Moment resistance; Stiffness; Ductility

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1. Introduction

In current industrial market, the demand of structures with a capability to store as much material as possible in a congested space has been increased drastically. Steel pallet racks (SPRs) are considered as most popular storage structures used in warehouses, industries and supermarkets. Throughout the years, steel pallet racking had been deeply evolved from hot-rolled profile into cold-formed profile in order to increase the optimization in terms of engineering. Current practice prefers cold formed steel for the construction of such structures [1]. SPRs are three dimensional structures and carry much higher load as compared to their self-weight. Since the SPRs are unbraced in the down aisle direction, therefore, to resist lateral actions such as seismic