

Large Web Openings in Cold-Formed Steel Joists- Reinforcement Strategies

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Abstract

The floor joists of cold-formed steel (CFS) structures may use large web openings to keep the floor height to a minimum. A cost-effective way to alleviate the detrimental effects of a large web opening is to affix appropriate reinforcements around the opening regions, to restore the original strength and stiffness of the member. A total of twenty-three laterally braced CFS joists were simply supported and subjected to uniformly distributed loads until failure for flexural tests, which considered solid sections, circular and square web openings (65% of web depth) and sections with reinforced web openings. The reduction in the flexural strength of a cold formed steel joist section due to a large web opening is less than 15%. Twenty-seven joist sections were subjected to short span, mid-span point load, shear tests to establish the shear resistances of sections having a large web opening and a reinforced web opening. The reduction in the shear strength of a CFS section with a web opening may be as high as 60%. Thus, the residual shear strength of a joist with a large opening may be as low as 40%. A Virendeel type reinforcement system can restore the original shear strength of a cold-formed steel joist section. Based on these studies it was concluded that; The mid 40% region of a joist (0.30L and 0.70L) can be defined as "Flexural Zone" and will need flexural reinforcements. The regions outside the mid 40% region of a joist can be defined as "Shear Zone" and will need the shear reinforcements.

Keywords

Cold-formed Steel Joists, Large Web Openings, Reinforcements, Experimental, Construction Guidelines.