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ORIGINAL RESEARCH

Out-of-plane capacity of cladding panel-to-structure connections in one-story R/C precast structures

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Abstract

The interaction between cladding panels and the main structure is a crucial point to assess the seismic response, and above all the structural safety, of RC precast industrial building. In the past, connections were often designed to allow construction tolerances and to accommodate both thermal and wind-induced displacements. The lack of specific details to allow relative in-plane displacements between cladding panels and the main structure often led to the participation of cladding panels in the structure seismic-resistant system with consequent connection failures. In the last decades, a lot of experimental tests were performed to investigate the in-plane performance of panel connections, and some design recommendations have been developed accordingly. In the out-of-plane direction, the connections were often considered to be infinitely rigid and not to suffer any damage by the seismic load. This work deals with the out-of-plane response of panel-to-structure connections for vertical panels typical of industrial and commercial precast buildings. Both standard hammer-head strap and new devices, called SismoSafe, were investigated. Tests were performed in the Structures and Materials Testing Laboratory of the Department of Civil and Environmental Engineering of Florence, where a specific setup was designed to perform cyclic and monotonic tests on the connection devices. Standard connections showed a rather limited resistance, while the innovative connections exhibited a high out-of-plane resistance. Numerical analyses were also performed on a case study building to evaluate the distribution of the out-of-plane demand on the connections.

Keywords Precast structures · Panel-structure connection · Experimental tests · Out-of-plane connection capacity · Nonlinear dynamic analysis

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