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INFLUENCE OF CYCLIC BEHAVIOUR OF BEAM-TO-COLUMN CONNECTIONS ON THE SEISMIC RESPOCE OF MR-FRAMES REGOULAR AND WITH "SET-BACKS"

ABSTRACT

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As suggested by traditional seismic design, the dissipation of the seismic input energy in moment resisting frames is located in the so-called dissipative zones that are some zones of structural members engaged in plastic range, properly detailed in order to assure wide and stable hysteresis loops. Depending on the beam-to-column joint typology, the dissipative zones can be located at the beam ends or in the connecting elements. In fact, beam-to-column connections can be designed either as full-strength joints, having sufficient overstrength with respect to the connected beam concentrating dissipative zones at the beams ends, or as partial strength joints, so that the seismic input energy is dissipated by means of the plastic engagement of one or more joint components properly selected.

The present work is aimed at the evaluation of the influence of beam-to-column connection typologies on the seismic response of MR-Frames starting from the knowledge of their cyclic rotational behaviour. The final goal is the development of more accurate methodologies for the assessment of the seismic performances of structures with partial-strength connections.

The investigated typologies are four partial strength connections whose structural detail has been designed in order to obtain the same flexural resistance leading to different values of joint rotational stiffness and plastic rotation supply. The first three connections are three partial-strength connections whose structural detail has been designed by means of hierarchy criteria, based on the component approach, aiming to obtain the same flexural resistance, but changing the locations of the weakest joint component. The last typology is a beam-to-column connection equipped with friction dampers properly designed to assure the earthquake input energy dissipation. This connection is equipped with friction pads whose stroke is calibrated depending on the displacement demands under destructive earthquakes.

The reason for investigating these beam-to-column joints is related to the availability of results dealing with their cyclic rotational response, tested as structural sub-assemblages at the Materials and Structures Laboratory of Salerno University. In fact, the rotational behaviour of these connections under cyclic loads is complicated by the development of strength and stiffness degradation and by pinching phenomena as the number of cycles increases which rules cannot be deduced by means of theoretical approaches.

An appropriate modelling of structures is needed to accurately represent both strength and deformation characteristics, especially with reference to partial-strength connections where the dissipation of the earthquake input energy occurs. Beam-to-column joints are modelled by means of rotational inelastic spring elements located at the ends of the beams whose moment-rotation curve is characterized by a cyclic behaviour accounting for stiffness and strength degradation and pinching phenomenon. The parameters characterizing the joints cyclic hysteretic behaviour have been calibrated on the base of experimental results aiming to the best fitting.

Successively, the prediction of the structural response of a MR-Frames equipped with such connections has been carried out by means of non-linear dynamic analyses carried out for increasing levels of the seismic intensity measure.