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Marianna Ercolino is a PhD in Seismic Risk and a Structural and Geotechnical Engineer. She has been working in the research field for the last 5 years; her research activity has dealt with several areas, with focus on different aspects of earthquake and structural engineering. During her Master studies, she spent a 6-month period in Ljubljana where she took part to the European project SAFECAST, aimed at studying the seismic performance of connection systems in precast buildings. She earned her PhD in Seismic Risk at the University of Naples Federico II (Italy) and her thesis investigated the seismic behavior of precast RC structures. After her PhD degree, she spent 6 month period as visiting researcher at the State University of New York in Buffalo (USA) where she worked in the Laboratory of Smart Structures Research Laboratory on non-destructive techniques for the structural monitoring, e.g. acoustic emission technique. She is currently a visiting researcher at the University of Greenwich (UK) where she is studying the seismic vulnerability of infrastructures, e.g. pipelines.

Seismic behavior of one-story RC precast structures

SUMMARY

Since the end of the Second World War, precast structures have been widely used in Italy and in Europe due to the several advantages of serial production of structural elements. Their specific function make the seismic safety of this structural typology an important issue both for the human safety and for the social and economic activities of entire regions. However, during some recent seismic events (Emilia, 2012; Turkey, 2011; L'Aquila, 2009), the large number of failures and recorded damages highlighted some deficiencies in the seismic response of this structural system. Both the widespread use of this typology and the revealed vulnerability motivated the presented research activities, which aim at investigating the seismic response of RC precast buildings, taking into account all the most important features, components and vulnerability sources.

The experience of precast structures performance in the Emilia-Romagna region (Northern Italy) during the earthquake on May 2012 was the basis of the whole work. Both the field inspections of the epicenter area and the extensive available data allowed identifying the main deficiencies of these existing buildings; such deficiencies mainly consisted in the inadequate strength of the connections systems and the detrimental panel-to-structure interaction under dynamic loads. Such damage typologies motivated two main activities: the investigation of the seismic performance of beam-to column connections and the assessment of the influence of the panels on structural response.

The failed beam-to-column connections in Emilia region were mostly frictional based connections, i.e. no mechanical devices were adopted to absorb horizontal actions. In order to justify these failures, the seismic assessment of an existing precast industrial building, located in Emilia region and hit by the earthquakes, was performed. In some more recent structures the failure of beam-to-column connections was also recorded in case dowel connections were employed. Both the recorded damage and the lack of provisions for the design of these connections in the modern building code (Eurocodes and Italian code) motivated the study of the seismic performance of a dowel connection by means of both experimental tests and numerical analysis. The outcomes of these investigations allowed evaluating the influence of some main geometrical features and the obtained connection strength were also compared to some code and literature provisions.

The large amount of collapses of cladding panel in precast structures was mainly caused by the failure of their connections; under dynamic actions, the interaction of the panel with the primary structure can significantly increase the demand forces in the connection compared to the design values. The developed study aimed at defining the dynamic properties as well as the nonlinear response of precast one-story structures if the panel-to-structure interaction is considered. The analyses results justified the extensive damage. Moreover, an innovative structural model was defined in order to assess the seismic performance of precast buildings by both modeling the panel-to-structure interaction and simulating the panel collapse during the seismic excitation.