On the nonlinear behaviour of joint connections between precast members realised using steel dowel

B. Belletti[a] (beatrice.belletti@unipr.it), C. Damoni[a] (cecilia.damoni@gmail.com), M. Scolari[a] (scolari.matteo87@gmail.com), A. Stocchi (ing.stocchi@gmail.com)
[a] *DICATeA – University of Parma – Parco Area delle Scienze, 181/a, 43124 Parma, Italy*

In the current paper the behaviour of joint connections realised using steel dowel are investigated. This kind of connections are widely used both in the new precast buildings and in the seismic improvement of existing precast buildings.

The seismic event occurred in Emilia Romagna in May 2012 emphasized the vulnerabilities of existing precast buildings related to the lack of connections between structural elements. For this reason a research program started between the University of Parma and the Unione Parmense degli Industriali (Parma Industrials Association) in order to investigate seismic improvement interventions on industrial precast buildings. Further research, partially developed in collaboration with TU Delft, has highlighted the importance of a realistic interpretation of this type of connections in terms of stiffness and strength.

Several works available in literature show that a steel dowel embedded in a concrete element and loaded by a shear force can be considered as a beam on elastic foundation and can be studied through the dowel action theory. Depending on the strength and dimension of the dowel, the position of the dowel relative to the concrete edge and the presence of edge reinforcement, two different failure mode are possible: a brittle failure mode related to the splitting of concrete surface (concrete splitting failure) and a ductile failure mode (steel flexural failure) leading to the formation of a plastic hinge in the dowel and the associated crushing of concrete.

Both of these failure modes are investigated in this paper, in particular parametric non linear finite element analyses have been carried out by varying the position and the length of the and by including edge reinforcement in the concrete element. The results obtained with NLFEA are compared with analytical formulations (e.g. MC2010, fib bulletin 43, Greek Code,etc.) and the experimental tests results available in literature.