

EUROPEAN PRE-QUALIFIED STEEL JOINTS (EQUALJOINTS)

Goal of the project

The goal of the project is to introduce in the European practice a qualification procedure for the design of moment resisting connection in seismic resistant steel frames, in compliance with EC8 requirements.

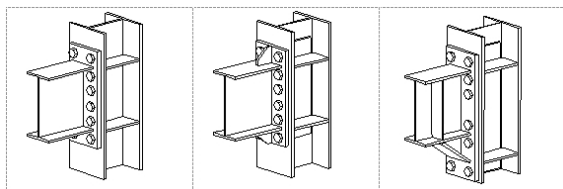
Particular objectives of the project are to qualify a set of standard all-steel beam-to-column joints, develop pre-qualification charts and design tools that can be easily used by designers. The project is also intended as a pre-normative research aimed at proposing relevant design criteria to be included in the next version of EC8. Besides it would contribute to the advancement of knowledge in the field of seismic behavior of steel moment resisting joints usually adopted in moment resisting frames (MR), in un-braced bays of dual moment-resisting/concentrically braced frames (MR+CB) and in moment-resisting/eccentrically-braced frames (MR+EB).

Short description of the project

The project is the first attempt in Europe to produce qualification tools for seismic-resistant joints. Novel design methodologies and details for beam-to-column connections that are reliable, feasible and economical, solving also the open issue of design by testing required by EC8 for partial strength/stiffness connections will be provided. The cyclic behavior of beam-to-column joints has a crucial role on the overall seismic response of both MR and dual frames. Recent studies highlighted the influence of joint rotation capacity on the seismic response of mid-rise MR frames designed according to EC8.

The innovative content of the project is represented by:

- Experimental investigations on 96 beam-to-column joint specimens covering: three typical European typologies and one US dog-bone joint typology made of heavy cross sections;
- Evaluation of the influence of different parameters (e.g. axial force, loading protocol and member sizes) on the joint performance;
- Development of codified pre-qualification charts of typical beam-to-column joints used in EU practice.



In Europe these tools do not exist in design codes. Hence, this project was intended as pre-normative research aiming to propose design guidelines for the future version of EC8.

Project implemented by

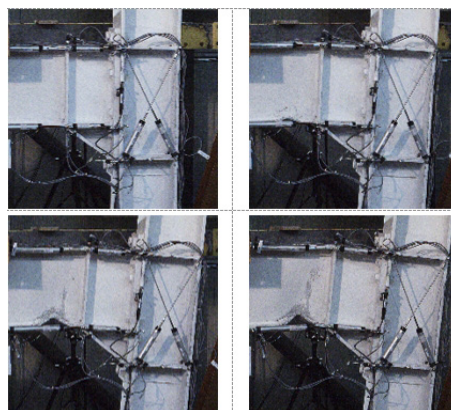
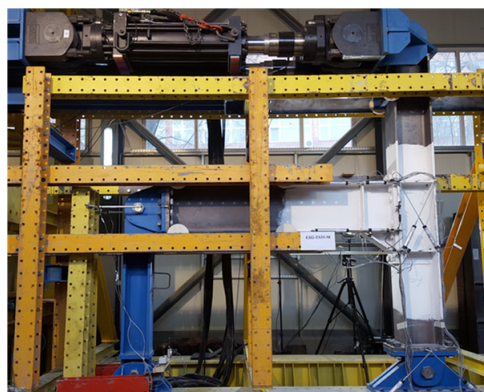
University of Naples "Federico II", Department of Structures for Engineering and Architecture.

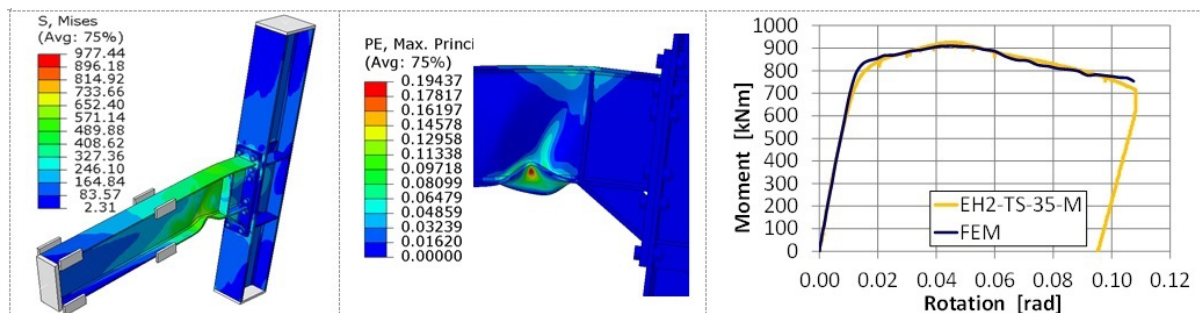
Implementation period

01.07.2013 – 31.06.2016

Main activities

Regarding the aim and objectives of the project, extensive experimental and numerical (FE) investigations were carried out with the purpose of evaluating the designed beam-to-column joint assemblies, and the influence of several parameters. The monotonic and cyclic response of 24 beam-to-column joints was evaluated. The numerical simulations comprised the calibration of joint models based on test results, and extension of the experimental program with a parametrical study.





Results

Particular results are represented by the experimental pre-qualification of bolted beam-to-column haunched connections. The numerical calibration of joint models allowed for a better understanding of the load transfer mechanism. The parametric study allowed investigating the influence of: member size, haunch geometry, web panel strength, and cyclic loading. Based on the experimental and numerical investigations, the design procedure was validated.

Applicability and transferability of the results

The project provides easy-to-use design tools for engineers and promotes saving cost solutions. Particular outcomes of the project are intended to be introduced within the new version of European seismic design code EN 1998-1. In addition, the outcomes of the project will be largely beneficial for the EU industry. Because the US joints examined within EQUALJOINTS will be made of heavy sections, which are produced only in Europe, this will be an important opportunity to get on the US Market, consolidating the gain of EU economy and having beneficial impact to exportation of EU products. The impact and transferability of the project is by no means restricted to the selected joint configurations and this project will open the door for other joints to be included in future updates of the guidelines.

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Research Centre

The Research Centre for Mechanics of Materials and Structural Safety – CEMSIG, Politehnica University of Timisoara.

Research Team

- University of Naples “Federico II” (UNINA) (coordinator of the project)
- Imperial College (IC)
- University of Coimbra (UC)
- University of Liege (ULg)
- Politehnica University of Timisoara (UPT)
- European Convention for Constructional Steelwork (ECCS)
- ArcelorMittal Belval & Differdange S.A. (AM)
- CORDIOLI & C

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