Impact loads in steel connections

Pedro BARATA
PhD Student, ISISE
University of Coimbra
Coimbra, Portugal
pbarata@uc.pt

Constança RIGUEIRO
Assistant Professor, ISISE
Polytechnic Castelo Branco
Coimbra, Portugal
constanca@ipcb.pt

Aldina SANTIAGO
Assistant Professor, ISISE
University of Coimbra
Coimbra, Portugal
aldina@dec.uc.pt

João Paulo RODRIGUES
Assistant Professor, ISISE
University of Coimbra
Coimbra, Portugal
jpaulocr@dec.uc.pt

Summary

After attacks on World Trade Center (2001), Madrid (2004), London (2005) and Mumbai (2008), special attention was given to the study of robust structures subjected at different accidental loads, allowing localized failure without being damaged to an extent disproportionate to the original cause. The collapse of the World Trade Center (WTC) showed problems in the design of structural elements: columns collapse, beams buckling and brittle failure of connections. Concerning this last topic, it was realised that the joint structural details plays very significant role behaviour in structures subjected to accidentals loads. The accidental loads may result from an object impact, blast, explosions, earthquake and fire.

The work presented in this paper corresponds to the first work package of the research project Impactfire, currently in development at the University of Coimbra; the behaviour of steel beam-column connections against accidental impact loading is the main objective of the project. The current paper is focused in: i) characterization of the impact scenarios in steel structures, ii) influence of strain rate sensitivity steel material model, and iii) previous research studies on the behaviour of steel beam-column connections against impact loading. At the end, the experimental programme of the research project Impactfire is presented.

Keywords: connections, design standards, high strain rate, impact scenarios, robustness, steel structures.

1. Introduction

The loads associated to an accidental event are normally with severe intensity and resulting in extraordinary consequences. Examples of accidental loads are: fire, blasts, impact, earthquake, avalanches, landslides, and so on; moreover, the combination of these scenarios must also be considered such as fire after impact or fire after earthquake. These topics are addressed in the strategic research agenda of the European Steel Technology Platforms [1], which cites the need for safety in the design, manufacture and performance of steel structures, especially against natural hazards and accidental loading. Thus, it is important to know the type and magnitude of the loads applied in the structure, when an extreme event occurs, in order to evaluate the corresponding response and the role played by each structural component to prevent progressive collapse of the structure.

The Eurocode standards present some specific parts for the design of structures in case of accidental actions such is fire (parts 1.2 of the Eurocodes) and earthquake (Eurocode 8). Additionally, part 1-7 of Eurocode 1[2] gives some guidelines and application rules for the assessment of accidental actions on buildings and bridges with the identified and unidentified accidental actions. The unidentified actions are related to robustness requirements. For the identified actions, impact and explosions are under the scope of this standard. This type of loads can be defined as impulsive, characterized

https://doi.org/10.2749/222137813807054601