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PLASTIC HINGES IN COMPOSITE STEEL-CONCRETE BEAMS SUBJECTED TO BENDING

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ABSTRACT

Many issues remain to be discussed regarding the composite steel-concrete structures design in seismic areas. In case of Eccentric Braced Frames (EBF), in the dissipative zones, connectors between the steel elements and the reinforced concrete slab are not applied usually. In this paper, the influence of applying connectors in the dissipative link subjected to bending is studied into an experimental program designed and conducted by the author.

Keywords: plastic hinges, dissipative zones, eccentric braced frames, composite sections.

INTRODUCTION

The frame structures with eccentric braced (EBF) are used world-wide and is the alternative to the centrically braced frames (CBF). The dissipative elements of eccentrically braced frames are characterised by the forming of plastic hinges, situated at the extremities of frame elements, preferably in the beams, and only at limit states in columns. The strength and ductility of EBF is directly related to the strength and ductility of the links. The seismic energy is dissipated by means of elasto-plastic shear cycles (for the short link), bending cycles (for the long link) and shear and bending cycles (for the intermediate link).

The main objective is to study the hypothesis which states that when no connectors are disposed in the plastic zone of a composite beam subjected to bending.

The experimental tests were made at the Technical University of Cluj-Napoca, Faculty of Civil Engineering, in according to the ECCS testing recommendations. Six specimens were tested in the experimental program, two of them having steel section and four of them having composite steel-concrete section, tested under monotonic and cycling loading.

RESULTS AND CONCLUSIONS

The hysteretic curves of the two composite specimens shawn in Fig. 1 (first specimen with connectors on the dissipative zone, second one without connectors between the link element and the reinforced concrete slab) has proven that the specimen with connectors on the dissipative element have a slightly higher ultimate force and rigidity and a slightly better dissipation capacity.

The composite solution did not lead to unwanted damage to the other elements of the frame.

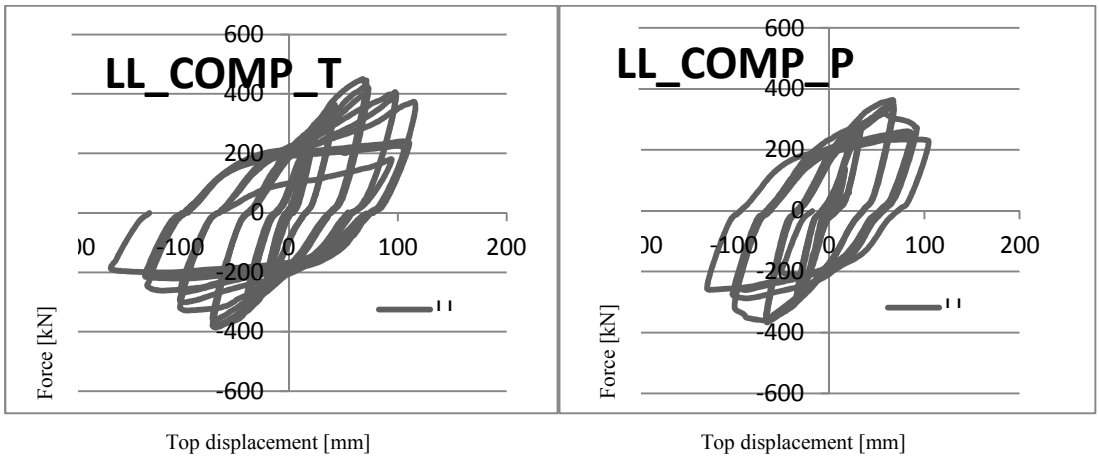

Fig. 1 - Tensile test results Load-displacement curve of the specimen LL_COMP_T (left) and LL_COMP_P (right)

The presence of concrete slab was rather beneficial for the global behaviour of composite specimens as compared to pure steel specimens.

REFERENCES

[1]-Ricles, James M. and Popov, Egor P. Experiments On Eccentrically Braced Frames With Composite Floors. Earthquake Engineering Research Center, University Of California, Berkeley, California..

[2]-Danku G. Study of the development of plastic hinges in composite steel-concrete structural members subjected to shear and/or bending. PHD Thesis, 2011.

[3]-ENV 1994-1-1. EUROCODE 4: Design of composite steel and concrete structures. Part. 1.1. General rules for buildings. Brussels: CEN, European Committee for standardization.