Numerical and analytical simulation of partially prestressed beams

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Abstract

An experimental shear test campaign of eight partially pretested isostatic I shaped beams is being carried out in the UPC Barcelona Tech Lab to analyze shear behavior of that type of prestressed elements under serviceably and ultimate state loads. The experimental campaign objectives are to study the influence of compression chord and pretress level in the ultimate shear load capacity and to analyze the influence of different stirrup spacing, different amount of reinforcement and levels of web compression due to prestressed in crack pattern and crack width.

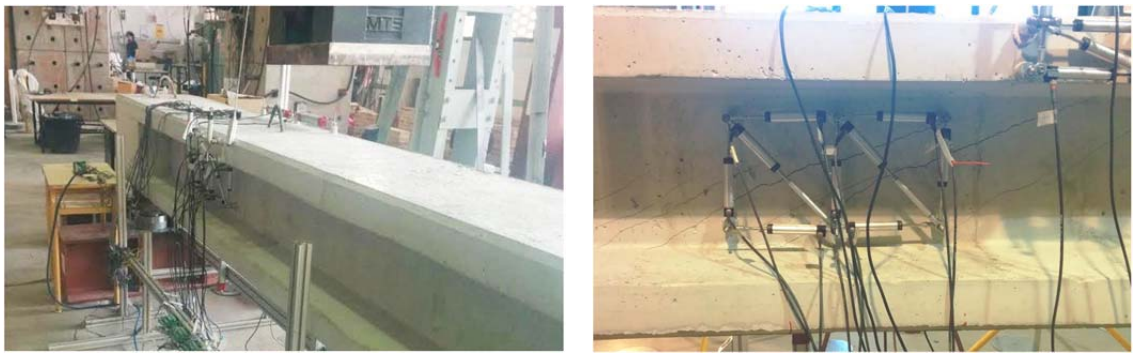

Fig 1: Experimental campaign

In this work one of the tested beams is analyzed using different numerical and analytical methods in order to compare different models accuracy with those obtained from the test considering both load capacity and crack patterns.

Two numerical models developed in the UPC, a 1D layered frame model with axial-shear-bending interaction (Ferreira et al. 2014) and a nonlinear fibre sectional model capable of simulating total interaction between all six beam internal forces (Bairán & Marí 2007), and commercial nonlinear finite element analysis program DIANA are used to predict results. Definition of the models, main variables affecting these models, as well as constitutive parameters needed and discussion of results are discussed.

Finally test results are compared with a new shear-flexural capacity model recently developed in the UPC (Marí et al. 2014); the model is mechanical-based relying on the assumption that

ultimate state shear is resisted mainly by stirrups if provided and by the un-cracked concrete chord.

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