

CIVIL ENGINEERING SEMINAR

Wednesday 19th March 2014 4pm
A401 – School of Engineering



RESILIENT MINIMAL-DAMAGE POST-TENSIONED STEEL FRAMES

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ABSTRACT

Steel self-centering moment-resisting frames (SC-MRFs) are a class of resilient structural systems that avoid damage in beams and eliminate residual drifts under the design basis earthquake (DBE). However, SC-MRFs have peak drifts similar to those of conventional steel moment-resisting frames, and so, experience appreciable non-structural damage under the DBE. The strategy of combining SC-MRFs with viscous dampers to achieve structural and non-structural damage reduction has not been fully assessed. Research towards the standardization of SC-MRFs within Eurocode 8 (EC8) is missing. This work presents a seismic design procedure for steel SC-MRFs with or without viscous dampers within the framework of EC8. The design procedure defines performance levels with respect to drifts, residual drifts and limit states in the post-tensioned (PT) connections. A preliminary pushover analysis is conducted at the early phase of the design procedure to estimate rotations and axial forces in PT connections instead of using approximate formulae. A fuse-PT bar system is used to avoid brittle failures in PT connections. A prototype building is designed as a SC-MRF with or without viscous dampers. Different designs of the SC-MRF with viscous dampers are considered to investigate all possible scenarios, i.e. use of dampers to achieve drifts significantly lower than the EC8 drift limit; to significantly reduce steel weight without exceeding the EC8 drift limit; or to reduce steel weight and achieve drifts lower than the EC8 drift limit. Nonlinear dynamic analyses using models capable of simulating all structural limit states up to collapse confirm the minimal-damage performance of the SC-MRFs, their superior collapse resistance, and the simplicity and validity of the proposed seismic design procedure.

ABOUT THE SPEAKER

Dr Tzimas completed his PhD in 2013 at the University of Patras. He specialises in the seismic design/assessment of steel structures. Now he works with Dr Karavasilis on: "Experimental and analytical studies on self-centering steel frames with fuse-post-tensioned bars and viscous dampers".

This seminar is open to all and refreshments are provided. For more information, contact Dr Stefano Utili by email at s.utili@warwick.ac.uk

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