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A strategic research cluster dedicated to the safety of civil engineering structures subjected to extreme effects induced by natural hazards, climate change and human activities

Conférence | Conference

Alternative dissipative mechanisms for advancing the seismic behavior of steel moment resisting frames

Conférencier | Speaker

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Switzerland

Date

26 Mar. 2026

Horaire | Time

12:15 - 13:30

Local | Room

M-2203 — Pavillon Lassonde

Polytechnique Montréal

Lien | Link

https://polymtl-ca.zoom.us/j/89673347333

Résumé | Abstract

The current status quo in prequalified beam-to-column connections pronounces flexural yielding in steel beams with fairly limited inelastic behavior within the beam-to-column web panel. Consequently, inelastic local buckling near the beam ends may occur at fairly modest lateral drift demands depending on the cross-sectional slenderness of the steel beam itself. As such, gradual flexural strength deterioration along with the destabilizing effects of gravity may control the overall seismic stability of steel moment resisting frames (MRFs) during low probability of occurance earthquakes. Besides, steel beam repairs are likely in the aftermath of a design basis earthquake, thus increasing downtime and functionality recovery. This presentation presents alternative concepts for welded connections that promote shear yielding within the panel zone and enable a very stable hysteretic response even at large inelastic deformations. Full-scale experiments along with coordinated computational studies demonstrate that fracture at kink locations of the panel zone is not a concern even when beveled weld backing bars are intentionally left in place after the completion of complete joint penetration welds at the bottom beam flange-to-column flange joints provided that current weld and fabrication practice is respected. The paper also presents a set of design requirements concerning the panel zone strength and the stability of welded connections with highly inelastic panel zones. Finally, the paper presents results from a series of high-resolution computational studies that substantiate the potential of such an alternative design concept to reduce the residual story drift ratios and downtime due to earthquake-induced structural repairs along the height of steel MRFs. Prospects of ongoing research work are also discussed.

Brève biographie | Short biography

Prof. Lignos is Professor and Chair of the Civil Engineering Institute at École Polytechnique Fédérale de Lausanne (EPFL). A key aspect of his research lies in the development of advanced models and approaches that leverage multi-scale experimentation to advance our understanding of the ultimate limit states that trigger structural collapse in steel structures. He holds degrees in Civil Engineering (NTU, Athens, 2003) and Structural Engineering (Stanford University, M.S. 2004, Ph.D. 2008). He was a post-doctoral researcher at Stanford University (2009) and Kyoto University (2010). He joined EPFL in 2016 from McGill University, Canada, where he was a tenured Associate Professor. His research has been acknowledged through several prestigious international awards, e.g. 2025 J.M.Ko Award (American Institute of Steel Construction) and the 2019 Walter L. Huber Civil Engineering Research Prize (American Society of Civil Engineers). His work on structural steel systems has emerged into the second generation of Eurocode 8, the AISC seismic provisions as well as CSA S16. He serves as an Editor of Earthquake Engineering & Structural Dynamics (EESD).