

Beyond Seismic Safety: Sustainable Retrofit Design

Real-world applications and emerging research frontiers

6 March 2026
Sala del Camino, IUSS Pavia

Event organisers: Gianrocco Mucedero & Martina Caruso



Valentina Bellotti

STRUCTURAL ENGINEER
ISAAC

Active mass damper solutions for healthcare building retrofit



Rita Bento

FULL PROFESSOR
INSTITUTO SUPERIOR TÉCNICO

Learning from case studies: retrofit and reconstruction of the built heritage



Alexandre Costa

CO-FOUNDER/PARTNER
NCREP

Interventions in existing buildings: operational challenges in Lisbon's historic centre



Chiara Passoni

ASSISTANT PROFESSOR
UNIVERSITY OF BERGAMO

Sustainability-conscious design for the renovation of existing buildings

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Session 2 – Research developments



Giulia Scagliotti

TEACHING ASSISTANT
STANFORD UNIVERSITY

Integrating embodied carbon into design and decision-making: practical challenges and the expanding role of structural engineers



Rita Couto

PHD CANDIDATE
IUSS PAVIA

An integrated regional prioritisation framework for seismic retrofitting of residential buildings



Kyujin Kim

PHD CANDIDATE
TU DELFT

Integrating heat and seismic risk: a multi-objective decision-making approach for façade retrofit design



Mattia Anghileri

RESEARCH FELLOW
POLITECNICO DI MILANO

Life-cycle structural performance of deteriorating bridges: computational modelling and experimental validation



Alejandro Calderón

SEISMIC RISK MODELLER
GEM FOUNDATION

Projecting the future of global building exposure

Beyond Seismic Safety: Sustainable Retrofit Design

Event organisers

Gianrocco Mucedero, University School for Advanced Studies (IUSS), Pavia, Italy

Martina Caruso, Global Earthquake Model (GEM) Foundation, Pavia, Italy

Seminar: “Real-world applications and emerging research frontiers“

6 March 2026 - Sala del Camino, IUSS Pavia

Opening session (9:00 – 9:10)

Welcome and introduction

Session 1 – Real case studies

- **Valentina Bellotti** – Structural Engineer, ISAAC (9:10 – 9:30)
Active mass damper solutions for healthcare building retrofit
This presentation introduces active seismic vibration control as a retrofit strategy for strategic facilities, with emphasis on healthcare buildings. It outlines the limitations of conventional strengthening in operational hospitals and presents the principles of Active Mass Damper (AMD) systems, clarifying the distinction between passive and active control. Experimental validation and real applications are discussed, highlighting benefits in terms of reduced downtime, indirect costs, and practical seismic risk mitigation.
- **Rita Bento** – Full Professor, Instituto Superior Técnico (9:30 – 9:50)
Learning from case studies: retrofit and reconstruction of the built heritage
This presentation focuses on the seismic assessment and rehabilitation of historic masonry buildings through selected case studies. It highlights the critical role of appropriate modelling and analysis strategies, showing how incorrect assumptions may result in unsafe or overly conservative interventions. The examples provide transferable insights to support reliable, economical, and sustainable decision-making in heritage conservation.
- **Alexandre Costa** – Co-Founder/Partner at NCREP (9:50 – 10:10)
Interventions in existing buildings: operational challenges in Lisbon's historic centre
This presentation addresses the dichotomy between seismic strengthening and historical preservation, balancing these aspects with cultural resilience and low-carbon solutions. To illustrate this, a recent case study of a typical Pombaline building is presented. Various seismic strengthening techniques were tested and their performance evaluated under different seismic demands, with their long-term environmental impacts assessed through a Life Cycle Assessment (LCA).
- **Chiara Passoni** – Assistant Professor, University of Bergamo (10:10 – 10:30)
Sustainability-conscious design for the renovation of existing buildings
The rehabilitation of existing buildings represents a priority for achieving global sustainability targets. However, the way retrofit interventions are designed has a substantial impact on the overall sustainability performance of the asset throughout its life cycle. This contribution introduces the concept of sustainability-conscious and Life Cycle Thinking (LCT)-based design of retrofit interventions. It then presents selected real-world case studies involving the application of exoskeleton systems for the integrated and sustainable upgrading of existing buildings typical of the Italian post-World War II period.

Coffee break (10:30 – 11:00)



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Session 2 - Research developments

- **Giulia Scagliotti** – Teaching Assistant, Stanford University (11:00 – 11:20)
Integrating embodied carbon into design and decision-making: practical challenges and the expanding role of structural engineers
This presentation examines the integration of embodied carbon into structural engineering practice using real case studies. It highlights practical barriers in current workflows and the role of structural engineers in influencing carbon outcomes through design choices and coordination. Trade-offs between cost and carbon are discussed, alongside strategies for effective multidisciplinary collaboration.
- **Rita Couto** – PhD Candidate, IUSS Pavia (11:20 – 11:40)
An integrated regional prioritisation framework for seismic retrofitting of residential buildings
This presentation discusses a prioritisation framework addressing seismic, energy, and socioeconomic vulnerabilities in the European construction sector, applied to mainland Portugal. It identifies priority areas for targeted renovations and resource allocation, supporting policies to enhance resilience, reduce emissions, and ensure equitable risk mitigation.
- **Kyuji Kim** – PhD Candidate, TU Delft (11:40 – 12:00)
Integrating heat and seismic risk: a multi-objective decision-making approach for façade retrofit design
A simulation workflow for quantifying the impact of seismic and heatwave events on buildings is presented. This involves the process of converting historical heatwave weather data into the weather file format required for thermal dynamics simulation. Design parameters related to both drift demand and energy demand are selected and form a parametric model. Finally, a method for selecting optimal sets of design parameters is briefly introduced, with the minimisation of damage and occupant discomfort as the design objectives.
- **Mattia Anghileri** – Research Fellow, Politecnico di Milano (12:00 – 12:20)
Life-cycle structural performance of deteriorating bridges: computational modelling and experimental validation
This presentation addresses the long-term reliability assessment of reinforced concrete bridges under deterioration and climate change. A life-cycle oriented approach under uncertainty is discussed, highlighting challenges related to data availability and model calibration. Selected case studies are presented to illustrate, calibrate, and experimentally validate methods for the long-term reliability assessment of corroded reinforced concrete bridges under climate change scenarios.
- **Alejandro Calderón** – Senior Seismic Risk Modeller, GEM Foundation (12:20 – 12:40)
Projecting the future of global building exposure
This presentation examines the need for forward-looking scenarios to assess building exposure and the inherent challenges of modelling the evolution of the built environment. Leveraging the Shared Socioeconomic Pathways (SSPs), three distinct trajectories for the global building stock by 2065 are explored: a shift towards safety and sustainability, a business-as-usual scenario, and a rocky road ahead. By quantifying the differences in exposure across these pathways, their implications for the future of seismic risk are highlighted.

Closing seminar



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