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Los Angeles County Museum of Art: Architectural Innovation through Base Isolation and Exposed Concrete

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In this issue

Abstract

Designed by Atelier Peter Zumthor in collaboration with Skidmore, Owings & Merrill (SOM), the new Los Angeles County Museum of Art (LACMA) building features an organic shape made of architecturally exposed concrete. The exhibition floor is supported by ten reinforced concrete service towers extending from the ground to the roof, utilising a post-tensioned framing system arranged in a repetitive rhomboidal pattern. Located in the seismically active Los Angeles basin, the site faces potential earthquakes from local faults (M_w 7.0+) and the San Andreas Fault (M_w 8.0). To safeguard irreplaceable artwork, engineers specified Triple Friction Pendulum bearings for horizontal isolation. Measuring over 2.5 m in diameter with 1.5 m of displacement capacity, these are among the largest bearings ever built. Non-linear dampers provide additional vertical seismic damping. The building is entirely monolithic and jointless, requiring a meticulously planned construction sequence to minimise the potential for concrete cracking. This paper details the unique engineering challenges and innovative structural solutions developed for this one-of-a-kind museum project. For further details and access to the full presentation, please refer to the recorded talk here.

1. Introduction

The architectural development of the new building for the permanent collection of the Los Angeles County Museum of Art (LACMA), designed by Pritzker Prize-winning Swiss architect Peter Zumthor, introduces an innovative concept featuring an elevated, single-level art exhibition space over a porous ground floor. This unique layout intentionally eliminates any hierarchy in the visitor experience, unlike other more traditional multi-story museums. However, combining these specific architectural principles with the desire to generate an organic geometry in exposed structural concrete presented a series of structural challenges.

Situated within the highly seismically active Los Angeles basin, the engineering team closely evaluated past seismic events like the 1994 Northridge earthquake and the 2017 Puebla-Morelos event in Mexico to select the appropriate level of building protection. Because the museum will host an extremely valuable art collection while serving as an architectural attraction, the design solutions advanced seismic criteria far beyond basic life-safety requirements, focusing heavily on investment protection and the preservation of historical and cultural heritage. Structural studies explicitly utilised resilient-based seismic criteria to evaluate multi-directional damping, minimise non-structural component damage, and reduce post-earthquake repair times. Beyond these design challenges, the subsequent construction phase introduced unique conditions, complex geometries, and strict requirements to execute a jointless, monolithic building while mitigating concrete cracking.

The structural system for the project relies on ten reinforced concrete service towers that create the ground-level porosity, as shown in the initial renderings (Figure 1).

These towers contain internal concrete shear walls with a thickness ranging from 250 mm to 1000 mm, which serve as the primary lateral load-resisting system. To isolate the building from ground motions, all ten towers rest directly upon Triple Friction Pendulum isolation bearings. The gravity system utilises post-tensioned reinforced concrete to support the long spans between towers, the bridge crossing Wilshire Boulevard, and the very long cantilevers. Both the floor and roof systems consist of a top and bottom concrete slab connected by vertical concrete ribs. The internal cavities between these slabs function as upper and lower plenums for the mechanical systems. The exhibition level maintains a constant structural depth of 1.45 m, consisting of a 225 mm top slab and a 200 mm bottom slab. Conversely, the roof level depth varies from over 2.0 m at the service towers to 1.25 m at the slab edges, incorporating 200 mm top and bottom slabs. To maximise structural stiffness at the longest cantilevers, intermittent gallery shear walls formed rigid Vierendeel panels between the floor and the roof, while link walls within the plenum spaces connected the chapel galleries to the service towers. Furthermore, the design extensively uses balanced double cantilevers, in which post-tensioning cable bundles are aligned with the principal tensile stress directions within the shear walls to counteract gravity forces. The various structural components are outlined in Figure 2.

This article is organised to detail the engineering challenges in sequence, with the first part analysing the post-tensioned gravity system, the second part focusing on the isolation system, and the final section discussing the monolithic construction challenges.

2. Structural Analysis and Design of the Post-tensioned Gravity System

The gravity system utilises post-tensioned (PT) reinforced concrete to support projecting cantilevers, long-span conditions between towers, and the bridge over Wilshire Boulevard. To manage strength, serviceability stresses, and long-term deflections, the design incorporates unbonded, 12 mm diameter monostrand tendons divided into three categories: slab PT, rib PT and walls PT. Slab post-tensioning is maintained at a constant centre of gravity in the middle of the slab to counter global cantilever behaviour. Rib post-tensioning is configured with an optimised, variable centre of gravity drape within the rib walls to counteract gravity loads. Wall post-tensioning extends from the Service Towers through link walls into gallery

Figure 1: Initial renderings for the new LACMA Building for the Permanent Collection by Atelier Peter Zumthor.

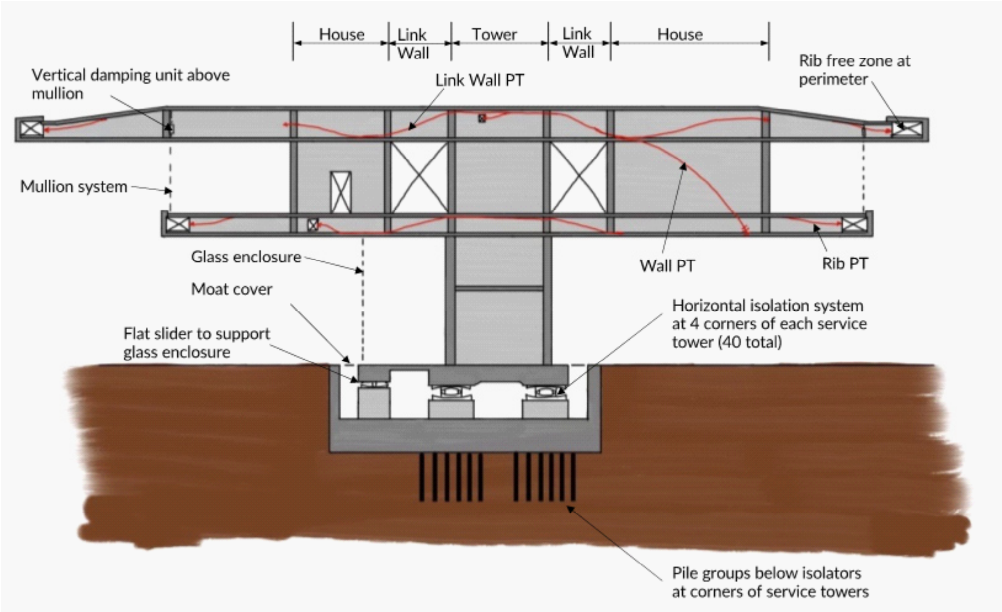

Figure 2: Conceptual building section showing cantilever structure hierarchy and seismic base isolation.

walls, with additional vertical post-tensioning added to house walls experiencing high shear and axial forces.

Designed in accordance with ASCE 7-10 and ACI 318-14, the reinforcement and sectional dimensions satisfy strength requirements for ultimate gravity, Design Earthquake, and Maximum Considered Earthquake load combinations. The layout also integrates strict deflection and service-level stress criteria to minimise immediate deflections, long-term deflections, and concrete cracking.

The building's superstructure was evaluated using two distinct 3D analysis software, ETABS and LUSAS. ETABS was used to perform the lateral response history analysis using nonlinear springs to model isolator boundary conditions, providing critical data on seismic demands. LUSAS was used for the gravity system analysis and captures the global geometry from the sloped roof to the ground level, including slabs, walls, and isolation framing. The LUSAS model (see Figure 3) sits on linear springs where the horizontal stiffness represents initial isolator properties and vertical stiffness matches pile stiffness. The key benefits of the LUSAS software specific to the LACMA project included the ability to accurately map tendon loads onto both horizontal and vertical surfaces for global post-tensioning modelling. It also employs a concrete cracking model to capture true global structural behaviour, and simulates concrete creep, shrinkage, and both initial and long-term post-tensioning losses across the entire structure.

3. Structural Analysis and Design: Lateral System

3.1 Site-specific Seismicity

Located within the Los Angeles basin, the project's site-specific seismicity is driven by nearby local faults capable of a moment magnitude (M_w) 7.0+ earthquake, as well as the San Andreas Fault capable of M_w 8.0 events. These conditions generate short-period spectral accelerations exceeding 2.0g, which would heavily impact a two-story concrete structure (Figure 4). Consequently, the project team decided early on to implement horizontal seismic isolation to protect the museum's invaluable art collection.

Lettis Consultants International performed the site-

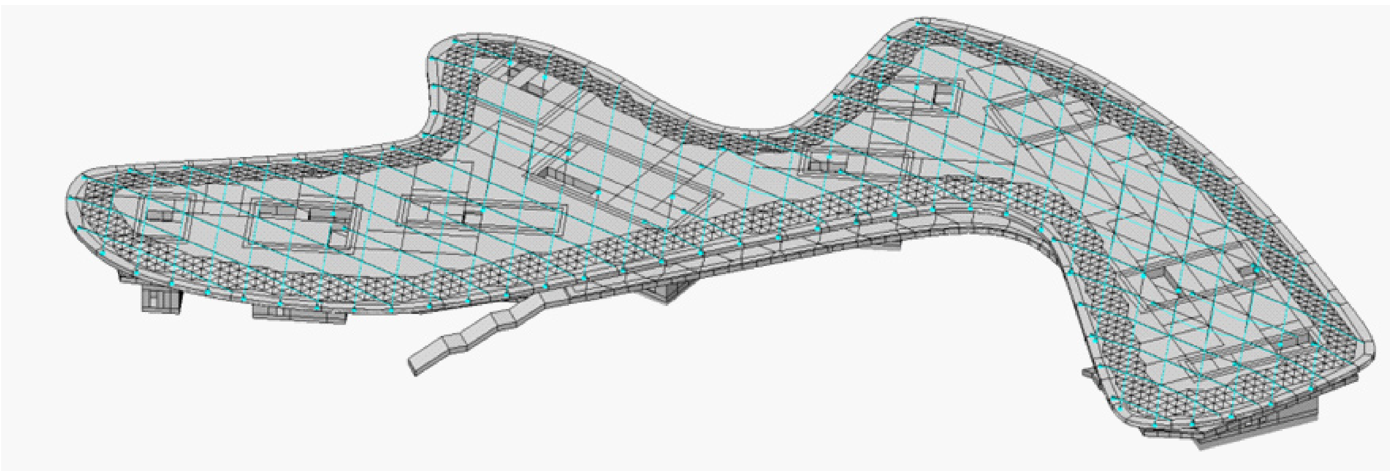

Figure 3: LUSAS model with Rib PT in the roof level ribs.

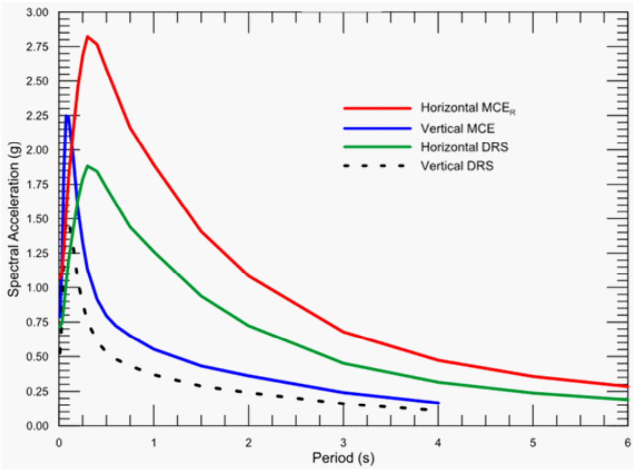

Figure 4: Site-specific horizontal (DE and MCER) and vertical seismicity.

specific hazard analysis, incorporating up-to-date data on basin effects and vertical-to-horizontal ratios to develop the horizontal and vertical design spectra. From this analysis, seven tridirectional ground motions were established for the Design Earthquake (DE) and Risk-Targeted Maximum Considered Earthquake (MCER) levels, as well as for service-level events with shorter return periods. These ground motions were then applied in ETABS to conduct seismic modelling and evaluate the overall performance of the isolation and damping systems.

3.2 Vertical Damping

Unusually high vertical-to-horizontal (V/H) ratios resulted in vertical spectral accelerations of roughly 1.5g, significantly affecting the design periods for the exhibition areas and roof-level cantilevers. To mitigate this, an evaluation of vertical isolation and damping alternatives was conducted. The team ultimately selected a vertical viscous damping system integrated directly into the façade system, offering the best balance between cost and performance gains.

This setup reduced peak vertical accelerations by approximately 30% compared to an undamped scenario. Manufactured by Taylor Devices, Inc., these viscous dampers are designed to pass through the lower roof slab without direct contact, anchored instead directly to the framing of the upper roof slab (Figure 5).

3.3 Seismic Isolation System

Triple Friction Pendulum bearings from Earthquake Protection Systems were chosen for the horizontal isolation system. Measuring over 2.5 m in diameter with a 1.5 m displacement capacity, these are among the largest isolation bearings ever built. They provide high-performance protection during Design Earthquake and Maximum Considered Earthquake events, using low friction and gradual transitions to minimise floor accelerations and protect the museum's artwork. In ETABS, these bearings were simulated using a triple series model, with nonlinear links calibrated to match the manufacturer's idealised hysteresis loop. As an advanced performance criterion exceeding ASCE 7, the mean peak displacement was strictly kept out of the stiffening range (Figure 6).

A global building model combining the horizontal

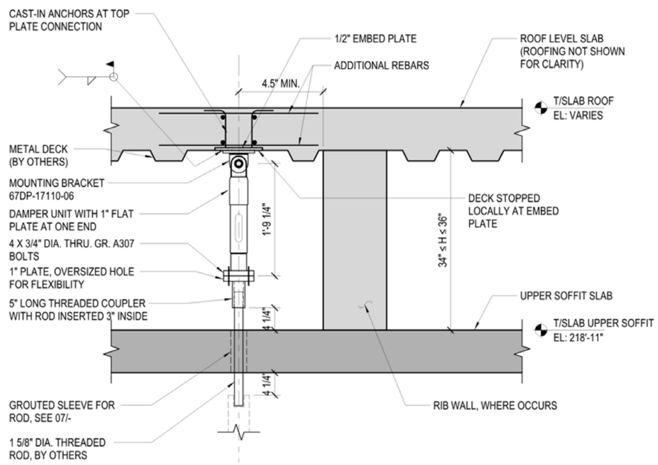

Figure 5: Vertical damper detail integrated with façade mullions inside the roof framing.

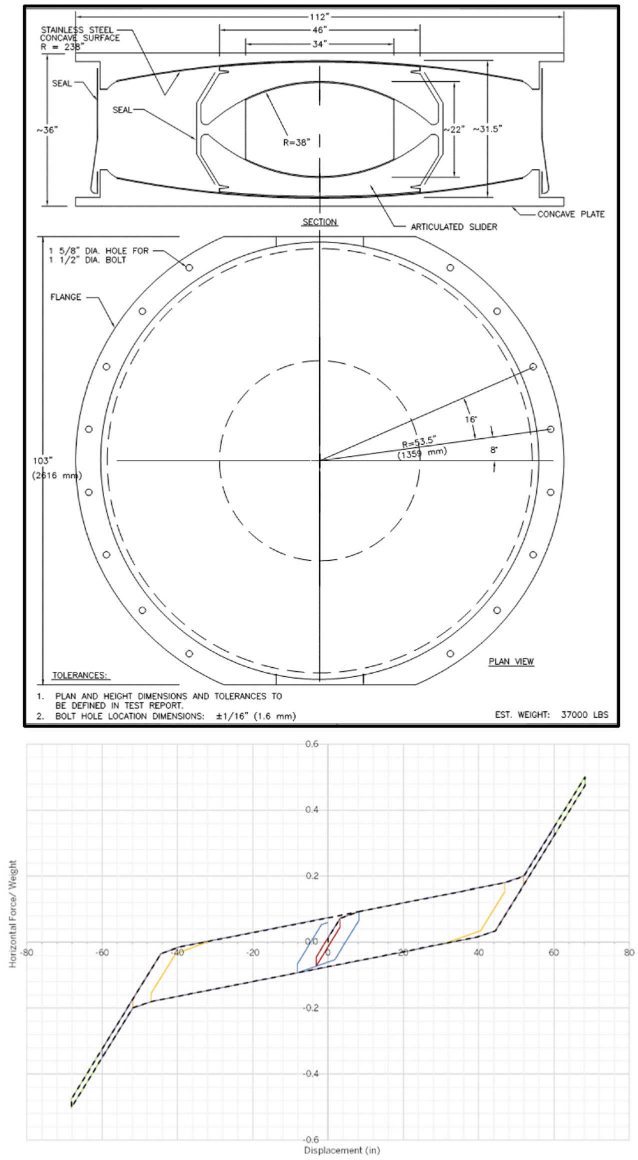

Figure 6: Triple Friction Pendulum bearings by EPS (top) and idealised hysteresis (bottom).

bearings and vertical nonlinear viscous dampers was analysed in ETABS using seven tridirectional site-specific ground motions. At the Maximum Considered Earthquake level, the high-performance bearings kept mean peak story drifts under 0.5%. Mean horizontal floor spectral accelerations remained under 1.0g in the short-period range and dropped well below 0.5g in the period range where most museum contents are found. Overall, the mean peak floor accelerations across the exhibition level remained well below 0.5g, representing an approximate 75% reduction in seismic demand compared to a traditional fixed-base structure.

To comply with ASCE 7 Chapter 17 requirements, the project utilised full-scale testing up to 1.3 m of lateral displacement, supplemented by reduced-scale prototype bearing tests due to the large size and load demands. Vertical stability loads during these reduced-scale tests reached approximately 45,000 kN (Figure 7). The combination of high vertical loads, shear forces, and large horizontal displacements generates significant secondary structural moments above and below the isolation plane. To safely absorb and transfer these forces, 3.0 m square reinforced concrete piers support the bearings from below to transmit reactions to the foundation. Above the bearings, tapered reinforced concrete corbels with variable depths were designed using Finite Element Method analysis and ACI 318-19 strut-and-tie models.

All 56 isolators for the project were fabricated and installed by the end of 2022 (Figure 8). Given the size and weight of the bearings, they had to be shipped one by one to the site on independent trucks.

Figure 7: Prototype testing of one of the bearings at EPS (full-scale).

Figure 8: Isolation bearings at EPS' factory (left) and during installation on site (right).

4. Construction Sequence

The construction sequence for the project was carefully studied in close collaboration with the General Contractor with several objectives in mind, among others: 1) achieve desired architectural concrete appearance 2) minimise cracking 3) maximise speed of erection. To achieve a high-quality architectural concrete appearance, the edge beam and soffit of the structure were poured monolithically. Temporary leave-outs were left in the perimeter ribs to allow post-tensioning cables to be stressed from the building's edge without exposing the tendon ends, while delayed pour leave-outs in the upper soffit accommodated initial concrete shrinkage. The tensioning sequence followed a precise path in both plan and elevation, moving vertically from the roof down to the exhibition level and walls, and horizontally from the north side of the site towards the south (Figure 9).

Designing this 255 m long structure as monolithic without traditional building joints required exhaustive modelling of concrete creep, shrinkage, and horizontal movements at the mullion lines. While locked isolators temporarily restrain movement and induce forces within the horizontal slabs and ribs, unlocking them allows the structure to breathe freely. The isolators' coefficient of friction was specifically engineered to ensure that internal concrete shrinkage forces could overcome friction and initiate movement.

An optimised unlocking sequence was developed to minimise overall movement, progressing inward from the northernmost and southernmost towers towards Service Tower F, which was released last. This strategy successfully controlled shrinkage-induced displacement, which peaked at 25 mm at the building's extremities and precisely matched the predicted value. While the lower soffit and exhibition slabs utilised the unlocked isolators to move, the upper soffit relied on its temporary leave-out pours to breathe independently before the final roof slab was poured to lock the entire structural system.

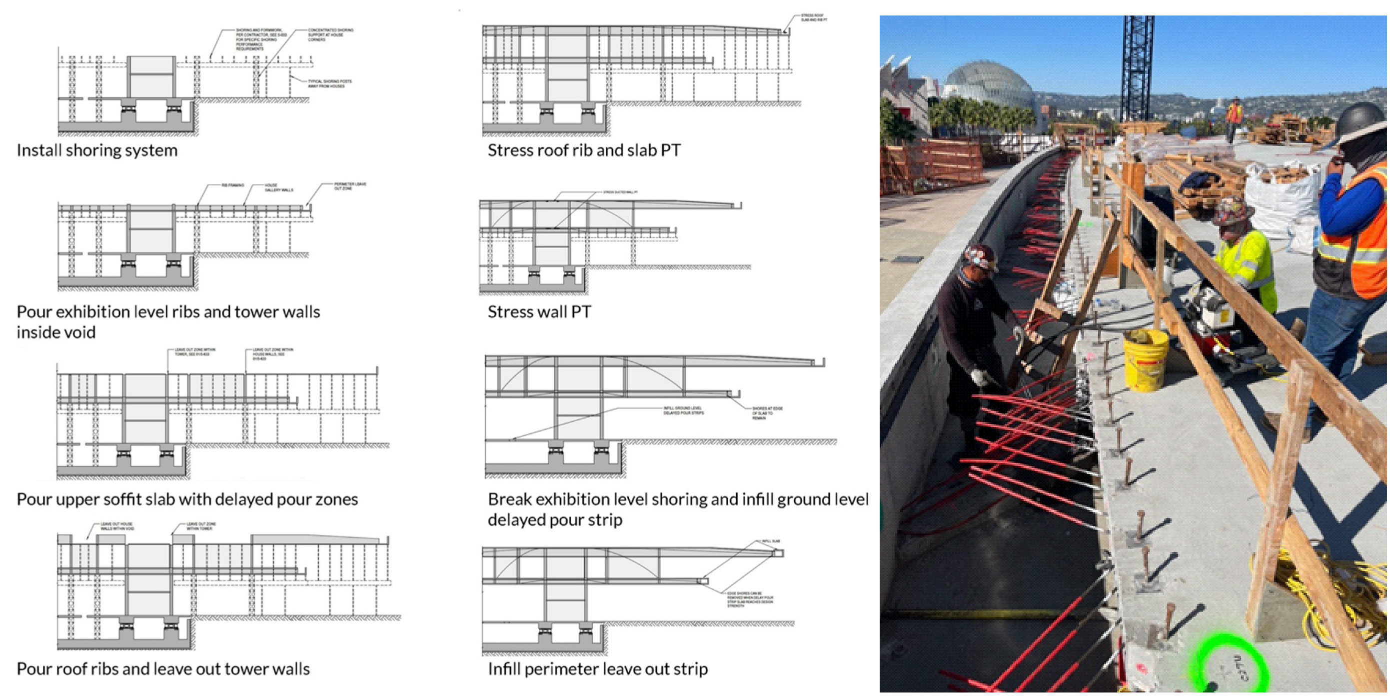

Figure 9: Construction sequence (left) and leave out at building perimeter (right).

5. Conclusions

The design of the new LACMA Building for the Permanent Collection presented various unique structural challenges, ranging from complex post-tensioning systems and a jointless monolithic structure to a highly detailed construction sequence, base isolation, and vertical damping. This paper has outlined the innovative structural strategies deployed to resolve those issues. The building opened to the public in April of 2026 (Figure 10).

6. Acknowledgements

The SOM team would like to acknowledge the collaboration of the Peer Review Panel (Bob Bachman, Michael Constantinou, Norm Abrahamson and Martin Button) and EPS (Victor Zayas, Anoop Mokha and Stanley Low) in this process.

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Figure 10: LACMA Building for the Permanent Collection (Image Copyright Ema Peter).

Innovative Floor Anchorage System for Low-Damage Seismic-Resistant Building Structures

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Abstract

This paper presents the development of a novel low-damage seismic system for building structures, termed the Inertial Force-Limiting Anchorage System (IFAS). The IFAS connects the floors to walls using deformable connections, thereby transforming lateral forces into relative floor motion that dissipates earthquake energy. The IFAS system has the potential to lower structural damage due to interstory drift, non-structural damage due to accelerations, and prevent failures related to higher mode effects. The deformable connection can be made of buckling restrained braces or friction dampers. The system employs an assemblage of rubber bearings and polyurethane bumpers to provide stability, impact protection and a measure of self-centering. The IFAS was developed through a National Science Foundation Natural Hazards Engineering Research Project led by the University of Arizona, and involving large-scale experiments at the University of California-San Diego and Lehigh University. The concept was prototyped, developed through computational simulation and large-scale component testing, and demonstrated through a large-scale shake table test of a 4-story building comparing the IFAS to a conventional building. The IFAS was shown to significantly reduce the seismic demands relative to the conventional system during a series of 20 strong ground motion events. The research has been presented in the February 2026 SECED Seminar. For further details and access to the full presentation, please refer to the recorded talk here.

1. Introduction

This article summarises the Feb 2026 SECED Seminar on the development of a novel low-damage system, termed the Inertial Force-Limiting Anchorage System (IFAS). The IFAS was developed through a multi-university project using large national laboratories in the U.S.

2. Methodology

2.1 IFAS Concept

The concept of the IFAS is to partially uncouple the Gravity Load Resisting System (GLRS) and Lateral Force Resisting System (LFRS) response through an engineered deformable connection between the two systems. Under daily service wind loads, the IFAS is sufficiently stiff and strong to transfer diaphragm forces in a similar fashion to a conventional structure. However, under a strong earthquake (or wind) event, the connection transforms force demands into relative displacement between the floor system and walls, thereby reducing response. The IFAS has the potential to reduce structural, non-structural, and content damage by limiting forces, drift, and acceleration compared with a conventional building structure.

2.2 IFAS Prototype Development

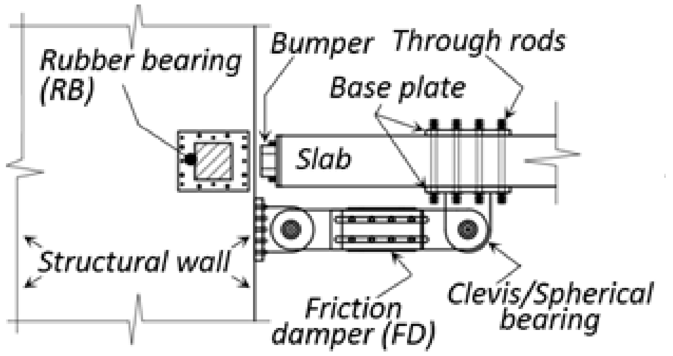
An IFAS prototype anchorage system was developed after a careful review of candidate components with practicing seismic design consultants (Tsampras *et al.*, 2016). The IFAS prototype (See Figure 1) consists of: (1) friction dampers (FD) or buckling-restrained braces (BRB) for the force-limiting components; (2) rubber bearings (RB) for the elastic restoring elements; and, (3) a polyurethane bumper, to limit the maximum relative displacement of the floor to the wall. These occupy a moat region that separates the wall and the floor.

Two IFAS systems were demonstrated through full-scale experimental tests at the NEES@Lehigh experimental facility (see Figure 2a). These included an IFAS composed of: (a) a BRB+RB as shown in Figure 2b (Tsampras *et al.*, 2017a); and, (b) a FD+RB IFAS as shown in Figure 3a (Tsampras *et al.*, 2017b). Test videos are available at Fleischman *et al.*, 2024a.

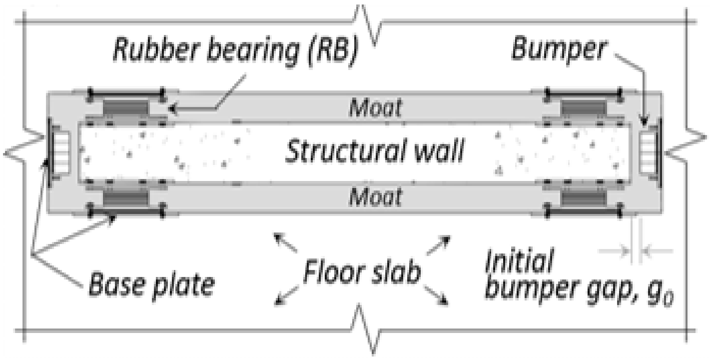
A feasible IFAS design space was determined through extensive analytical research, using nonlinear models of a multi-story reinforced concrete (RC) flat plate shear wall evaluation structure. Analytical studies of the system indicated the need for a bumper element (refer to Figure 1b) to limit excessive relative displacements and gravity system drifts in the maximum credible earthquake without damage due to impact. The bumper element was characterised subsequently through component testing at NEES@Lehigh (see Figure 3b).

2.3 IFAS Proof of Concept Testing

The advantages of the IFAS prototype were demonstrated through shake table tests carried out at the NEES@UCSD facility and with a direct comparison to a conventional structure (Zhang *et al.*, 2018). A 4-story half-scale building structure was used in the test program (see Figure 4a) based on a full-scale RC flat plate shear wall prototype structure. The test structure preserved the cast-in-place RC flat plate floor systems; however, the RC columns and shear walls were replaced by precast hybrid walls (ACI, 2022) for test repeatability (Fleischman *et al.*, 2025). The building was designed to be converted to different structural system: (1) Phase I - IFAS low damage system; (2) Phase II - Conventional floor anchorage system. This goal was accomplished through slotted inserts embedded in the precast wall units, left unattached during Phase I, and connected for Phase II. The convertible, repeatable structure allowed a direct comparison of the IFAS to conventional.

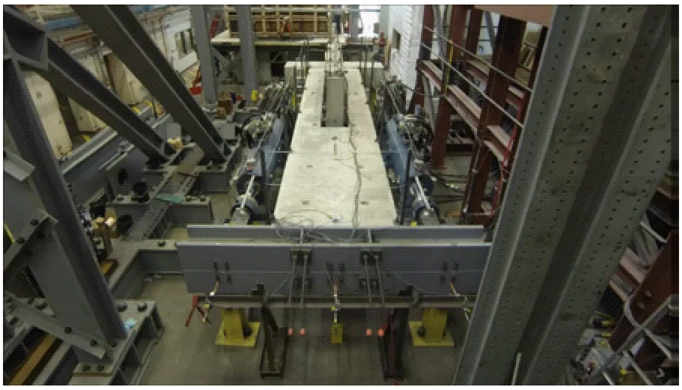


(a)

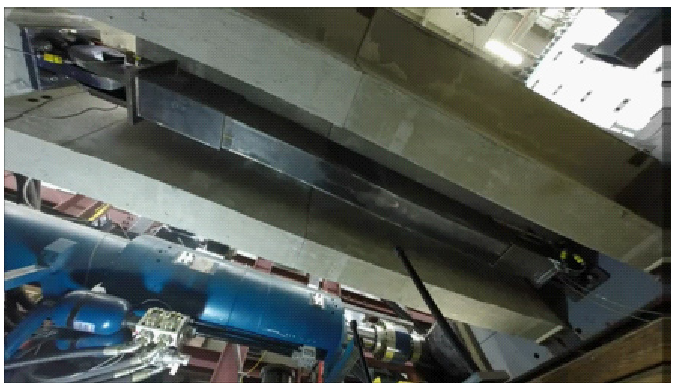


(b)

Figure 1: IFAS FD prototype: (a) Elevation; (b) Plan view (after Zhang *et al.,* 2018).

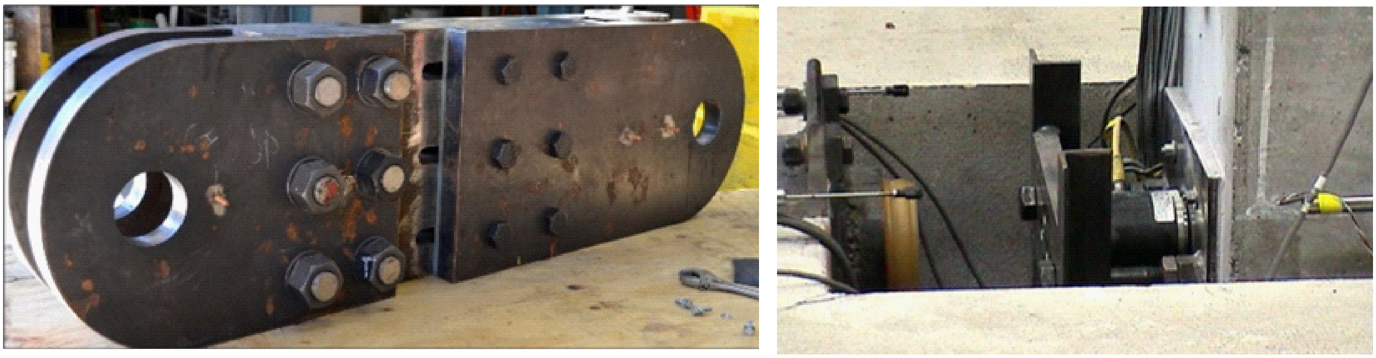


(a)



(b)

Figure 2: IFAS Prototype Testing: (a) Wall Stub Specimen, NEES@Lehigh; (b) Underside view of BRB.



(a) *(b)*

Figure 3: IFAS Prototype Testing: (a) Full-Scale FD; (b) Impact Testing of Bumper Element, NEES@Lehigh.

The NEES@UCSD table was a single DOF table at the time of the test program. To permit the evaluation of both a FD IFAS system (EW LFRS, Figure 4b) and a BRB IFAS system (NS LFRS, Figure 4c), the EW wall was located eccentric to the center of mass to create a torsionally-sensitive structure. This condition permitted evaluation of the IFAS prototype under the complex three-dimensional kinematics of a realistic structure in a seismic event.

The specimen was nominally half-scale relative to the full-scale prototype structure. However, the cast-in-place floor slab thickness was maintained at full-scale to provide the appropriate tributary seismic mass to the IFAS system. The use of a full-scale slab relative to the half-scale structure produced a weak column/strong slab scenario, creating the potential for a story mechanism in the gravity system columns. To preclude this situation, a novel pinned high strength precast column detail was developed for the gravity columns in the test structure.

3. Results And Discussion

The response of the IFAS structure (Phase I) is compared to the conventional structure (Phase II) at four ascending levels of seismic demand for a moderate (*i.e.* Seattle - SE) and high seismic (i.e. Berkeley - BE) sites at Service (SVC), Design (DBE), and Maximum Considered (MCE) earthquakes. Test videos are available at Fleischman *et al.*, 2024b.

Figure 5 compares the primary wall base rotation time histories for Phases I and II for (a) SE DBE; (b) BE SVC; (c) BE DBE, and (d) BE MCE. Note that for the first three ground motions, this response is from the main (NS) wall in the direction of excitation. For the last ground motion (BE MCE), the transverse (EW) wall is used due to the domination of the building's torsional mode. In the plots, the Phase I (IFAS structure) plots are in red; the Phase II (conventional structure) are in blue. The results indicate a significant reduction in response for the IFAS structure relative to the conventional structure at both intensity levels.

4. Conclusions

A new low-damage system, the Inertial Force-Limiting Floor Anchorage System (IFAS), has been developed for reinforced concrete (RC) shear wall structures. The IFAS uses a deformable connection to transform inertial forces during major earthquakes into relative displacement of the floor system, lowering demands in these events. The following conclusions are made regarding the research performed to develop the IFAS:

- The IFAS shows the potential to: (a) significantly lower LFRS drift demands in the design earthquake, and hence the potential for less structural damage; and (b) lower floor accelerations relative to those that will occur in stiff undamaged structures.

(a) *(b)* *(c)*

Figure 4: IFAS Shake Table Testing, NEES@UCSD: (a) Test Structure; (b) FD, EW wall; (c) BRB, NS Wall.

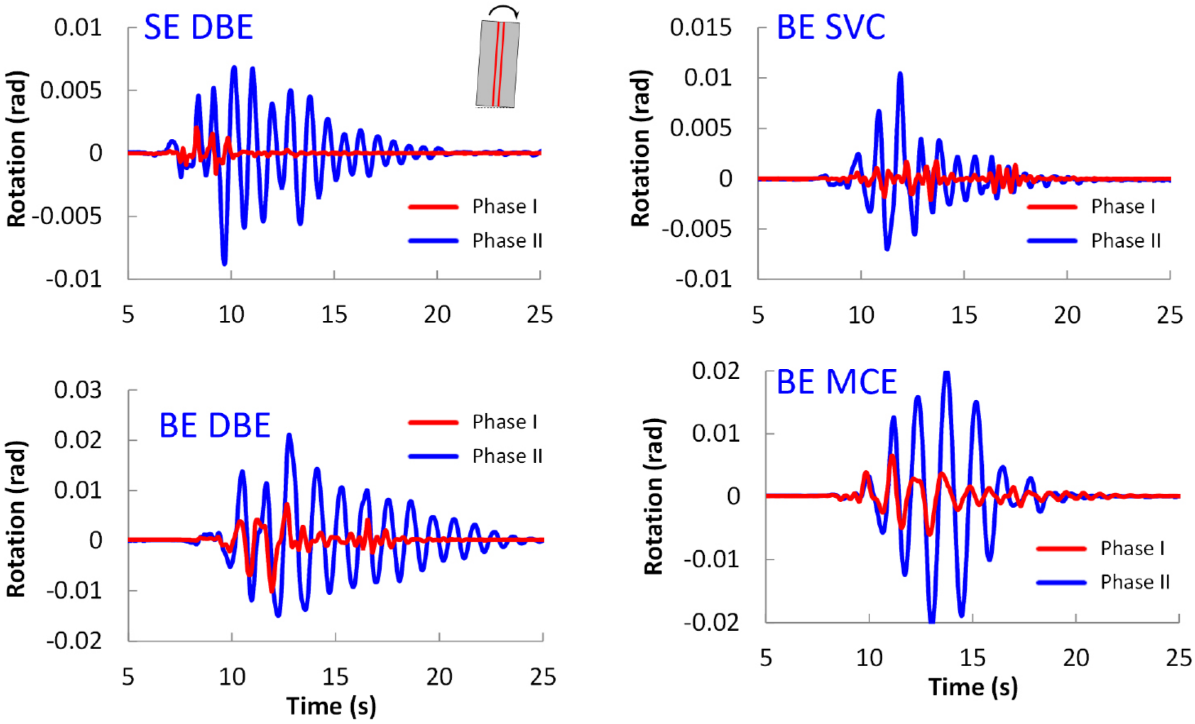


Figure 5: Shear wall base in plane rotation: (a) SE DBE; BE: (b) SVC; (c) DBE; (d) MCE.

- Friction dampers or BRB with proper articulation are cost-effective solutions that meet the anticipated force and deformation demands.
- Rubber bearings between the wall and slab provide the required stability and elastic restoring forces to limit residual floor displacements.
- The use of a bumper device with an appropriate initial gap in the IFAS will prevent excessive relative floor displacements at the MCE.
- Models have been calibrated in order to determine the feasible design space for IFAS designs.

5. Acknowledgements

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Fuse-based Segmentation: A Novel Design Approach for Preventing Progressive Collapse of Buildings

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Abstract

Currently, we are living in an era marked by climate change and geopolitical tensions, where extreme events are becoming more frequent and severe. Such extreme events may trigger local initial failures in buildings that propagate throughout the structural system. This phenomenon, known as progressive collapse, is a significant concern for our society due to its catastrophic consequences, including loss of human lives, economic impacts, and environmental damage. To prevent such occurrences, current design philosophies rely on improving continuity between structural members so that loads supported by failed components can be redistributed to the remaining structural system. However, when large initial failures occur, this continuity can backfire and contribute to collapsing elements pulling down parts of the building that would otherwise be unaffected, thus increasing the risk of disproportionate collapse. A novel design approach, called fuse-based segmentation, is proposed to address this issue. The approach aims to provide sufficient continuity to develop alternative load paths while also ensuring the building's ability to segment and isolate collapse when the initial failure is too large to contain (i.e., when a new equilibrium state cannot be achieved through load redistribution). This new approach provides a last line of defence against catastrophic collapses, leading to a more resilient built environment. For further details and access to the full presentation, please refer to the recorded talk here.

1. Introduction

Building collapse, whether caused by natural disasters, design errors, or ageing, poses profound and far-reaching consequences for society, affecting not only the immediate victims but also the broader community and the socio-economic fabric of the affected region. Most of these collapses were initiated by local damage to critical elements of buildings, which then triggered further failure propagation (a domino effect), often resulting in a final collapse disproportionate to the initial damage. Such a phenomenon is widely known in the engineering community as progressive collapse (ASCE 7, 2022; Ellingwood, 2006; Krauthammer, 2008). Throughout the years, some infamous cases of building collapse exist: Ronan Point Tower in London in 1968; Capitán Arenas Apartment Block in Barcelona in 1972; the A.P. Murrah Federal Building in Oklahoma in 1995; the Sampoong Department Store in Seoul in 1995; the Hard Rock Hotel in New Orleans in 2019; the Champlain Towers South in Miami in 2021. Such events typically lead to significant consequences for human lives and the economy (Caredda *et al.*, 2023; Adam *et al.*, 2018; Breysse, 2012; Delatte, 2003; Hingorani *et al.*, 2020).

Although the consequences of such events are devastating, formal design guidance for preventing progressive collapse did not exist until the 1970s, particularly following the infamous Ronan Point Tower collapse in the UK. This can be considered quite recent when compared to seismic codes, which have been around since the 1920s (half a century earlier). The formal guideline for preventing progressive collapse, named Code of Practice 110 (CP 110, 1972), requires some ties (continuous elements) to be placed in certain areas of the building to resist cantilever, catenary, or other actions resulting from accidental events. Such ties must be installed horizontally and vertically, and they are designed to develop alternative load-carrying mechanisms when the structure loses its primary (predefined) load path. This continuity allows the redistribution of loads from the failed structural component to the remaining parts of the structure (i.e., finding a new equilibrium through load redistribution). Since then, many more studies, standards, and guidelines have been published in the field of progressive collapse (EN 1991-1-7; UFC-4-023-03; ASCE 76-23), but the consensus has remained the same, where the principal measure to increase building resistance against progressive collapse is to provide extensive continuity throughout the building, while also ensuring sufficient energy absorption capacity, ductility, and redundancy throughout the building system. Although such a concept has been effectively proven to accommodate small initial failures, it may not be viable or sustainable when dealing with larger ones (Starossek, 2017; Thöns, S. & Stewart, M. G, 2020). Indeed, several major collapses have occurred due to large initial failures, including the recent collapse of Champlain Towers in Miami in 2021 (Blaskey *et al.*, 2021, 2022). In such circumstances, the provided ties, intended to provide continuity, can backfire as the collapsing parts pull down the rest of the structure. In other words, continuity can be harmful in certain scenarios by "bridging" the propagation of failure, leading to more disastrous consequences (Starossek, 2017; Makoond *et al.*, 2024a). Such a limitation highlights the urgent need to develop new design approaches to address the clear shortcomings of current approaches.

Within the framework of Endure, an ERC Consolidator Grant project hosted at the Universitat Politècnica de València, and Encast (an ERC Proof of Concept Grant), we develop a novel approach called fuse-based segmentation to arrest collapse propagation in buildings, with the latter project exclusively focusing on precast building systems. The approach, which controls the hierarchy of failures within the system's structural components, is inspired by how lizards shed their tails to escape predators. It synergistically combines continuity to allow redistribution of internal forces for small initial failures and segmentation to arrest and isolate collapse propagation for larger failures. To validate the fuse-based concept, we first designed four prototype subassemblies for laboratory testing and then extrapolated the findings to a full-scale precast building specimen. Two additional full-scale buildings (a steel-frame and a cast-in-place RC building) are also tested, but are outside the context of the current article. While the laboratory subassembly tests allowed us to better interpret and characterise the mechanism and failure mode at the detailed connection level, the latter complements it with a new understanding of system-level building performance. The key findings from each test campaign are presented in the following sections. For readers interested in theoretical frameworks behind the development of the fuse-based segmentation concept and its implementation (including the cost-benefit analysis), more detailed discussions can be found in Caredda *et al.* (2024, 2025).

2. Laboratory Subassembly Tests

A traditional test in the progressive collapse field is usually carried out using a pushdown setup, in which a (simplified) 2D-planar frame with two spans of beams is gradually pushed down at the span junction (representing a middle column removal). Although such tests provide a useful understanding of how the beam element would respond to local failure by developing alternative load paths through a combination of flexural, arching, and catenary mechanisms, it does not accurately represent system-level collapse behaviour. In fact, real collapse scenarios always involve the activation of load-resisting mechanisms of various building elements, which cannot be represented in such a simplified beam pushdown test. As the objective of Endure is to test the new approach to arrest collapse propagation, a new setup is necessary that better captures the key phenomena during a collapse process, which typically involves column failures. To anticipate this, a novel test setup was developed. Advanced numerical simulations were utilised to design the specimen and the corresponding setup to closely replicate the systemic behaviour

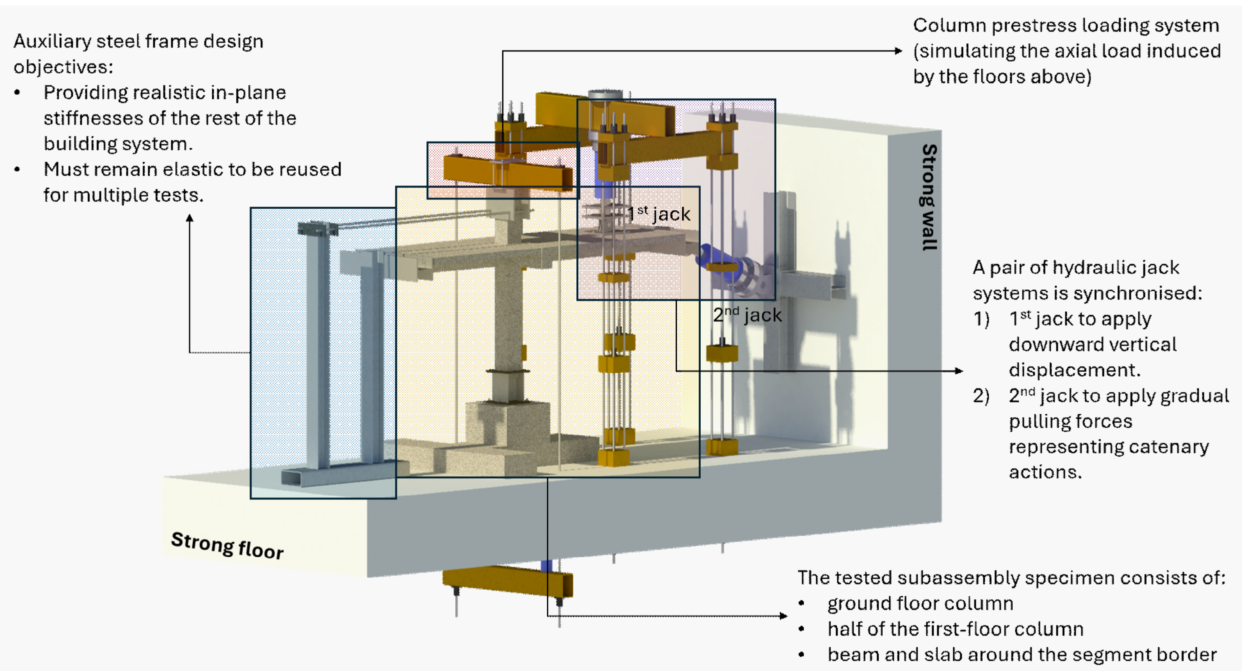


Figure 1: The newly developed test setup that mimics the system-level boundary conditions during a collapse event.

of a building during a collapse. Three critical aspects of the design include: 1) a more realistic stiffness/restraint of the boundary conditions was designed to mimic the actual stiffness of the rest of the building (the remaining upright parts); 2) the contribution of floor slabs in cast-in place systems, which is generally neglected in traditional tests, is partially accounted for by adopting a T-beam specimen (using the slab effective width as a reference); 3) a comprehensive loading protocol was adopted by combining three synchronous loading systems that represents the evolution of the internal forces of the building system at different collapse stages. The sketch illustrating the key components of the new setup is shown in Figure 1.

The boundary conditions and loading protocols for this setup were derived from numerical simulations of a realistic building collapse scenario (Setiawan *et al.*, 2024; Makoond *et al.*, 2024b). The resulting subassembly specimen represents three distinct components:

1) **The collapsing section - the area directly affected by the initial failure (refer to the purple-shaded boxes in Figure 1)**: In a real collapse scenario, the unbalanced forces transmitted from the collapsing parts to the rest of the building fluctuate dynamically throughout the collapse process. However, this is very difficult to simulate in a laboratory environment (especially in real time). Therefore, instead of linking the phenomenon directly to time, we expressed the change in internal forces in terms of the structure's deformed state (element rotations and deflections). This is done by configuring a pair of hydraulic jack systems: a vertical actuator to control the beam's vertical deformation, and a horizontally inclined actuator to produce a specific magnitude of pulling force based on the vertical jack's deformation. In this way, for a specific set of deformations, we can impose the pairing forces, leading to consistent kinematics.

2) The upright section - the portion of the structure expected to remain stable (refer to the blue-shaded boxes in Figure 1): The remaining upright parts of the structure are represented by external steel frames. The frame provides restraints to the specimen and controls the level of lateral deformation (drifts) once the unbalanced forces are transmitted by the loading system. To provide a correct estimate of the deformation level for a specific unbalanced force, the restraining frame's stiffness was calibrated to match that of the remaining upright parts from the collapse simulations. The final design of the steel frame is composed of two individual columns made of HEB220 profiles, which are connected to the specimen using high-strength bars at the first-floor slab elevation and at the mid-height of the first-floor column.

3) The segment border – the subassembly specimen itself, where the fuse mechanism is implemented (refer to the yellow-shaded boxes in Figure 1): The boundary between the intact and collapsing parts, where the fuse-based segmentation approach is implemented. Different methods were applied for the precast and the cast-in-place specimens. In the precast system, the segment border is positioned at the connection, where the fracture of the top beam bars controls the separation mechanism. Meanwhile, the cast-in-place specimens were constructed using a newly developed structural fuse (made of modified rebar couplers), installed around the zero bending moment region (contraflexure).

Using the new setup, four subassembly tests have been successfully carried out. The results suggest that the fuse mechanism can be activated at a reliable level of the (predefined) design load, without interfering with the structural system's ability to develop alternative load paths. As the fuse was activated (refer to Figure 2), the segment border ruptured and halted the force transfer between the collapsing parts and the remaining upright parts of the structure. In particular, this mechanism helps protect the columns from large deformations, which may otherwise lead to the loss of stability and integrity of the entire building system. As expected, different positions of the segment border and failure mechanisms occurred, particularly in the cast-in-place and precast specimens. In the cast-in-place system (Figure 2a), the fracture location coincides with the position where the structural fuse was installed (about 1 m from the column face). The activation of the fuse placed at the beam triggers an abrupt load redistribution to the slab rebars in the same plane, leading to the fracture of all slab rebars there. This separation occurs after the beam deformed quite largely (about 0.15-0.20 radians), which suggests that the fuse activation mechanism does not impair the deformation capacity (ductility) of the system and therefore the development of other alternative load paths, including catenary mechanisms, but also plastic hinges in seismic design, can be guaranteed. In contrast, in both precast tests, the segmentation occurred at the connections (as designed). A comparison of the two precast tests reveals distinct trade-offs between load capacity and segmentation. Specimen 1 (Figure 2b-left), featuring continuous top and bottom reinforcement, sustained a higher peak pulling force, demonstrating a superior capacity for developing catenary action. However, this enhanced strength has its own limitation (drawback) as it unfavourably increases the demand forces that must be resisted by the supporting column. Consequently, the column exhibited greater horizontal deformations and bending moments, leading to minor cracks. In contrast, Specimen 2 (Figure 2b-right) was designed with only continuous top bars, with bottom bars terminated at the corbel face. Because the top reinforcement had already undergone substantial strain during the initial flexural stage, it lacked the residual capacity to transition into a catenary mechanism, resulting in an abrupt failure (with a very minimum deformation during the catenary state). However, as this connection is primarily designed to develop alternative load paths through the flexural mechanism of the beam and slabs, a limited catenary is not a concern. In all the tests discussed above, it can be concluded that segmentation occurred as intended, protecting the columns and the rest of the specimens from propagating collapses.

3. Full-Scale Precast Building Test

In total, three full-scale building tests are planned within the framework of Endure: 1) precast concrete building, 2) cast-in-situ building, and 3) steel building. All three buildings are designed with the same geometries: 3 × 2 bays, with a 5 m span in the three-bay direction and a 6 m span in the two-bay direction, and two-storey floors. These key geometries are kept constant to allow a systematic comparison of the three buildings. Until the writing of this newsletter, we had successfully tested and published the results on the precast concrete building and executed the steel building test (but the results are still being processed). Meanwhile, the cast-in-place building is still under design stage and will be tested later in Q4 of 2026. Therefore, only a summary of the first precast building test will be described in the following.

The purpose-built precast specimen had two 2.6 m high floors with a 15 × 12 m floor plan (Figure 3a). The columns were made of precast elements with a dimension of 40 × 40 cm, whereas the beams were partially precast with a depth of 61.5 cm (35 cm precast + 26.5 cm cast-in-situ topping) and a width of 40 cm. The top continuity bars of the beams

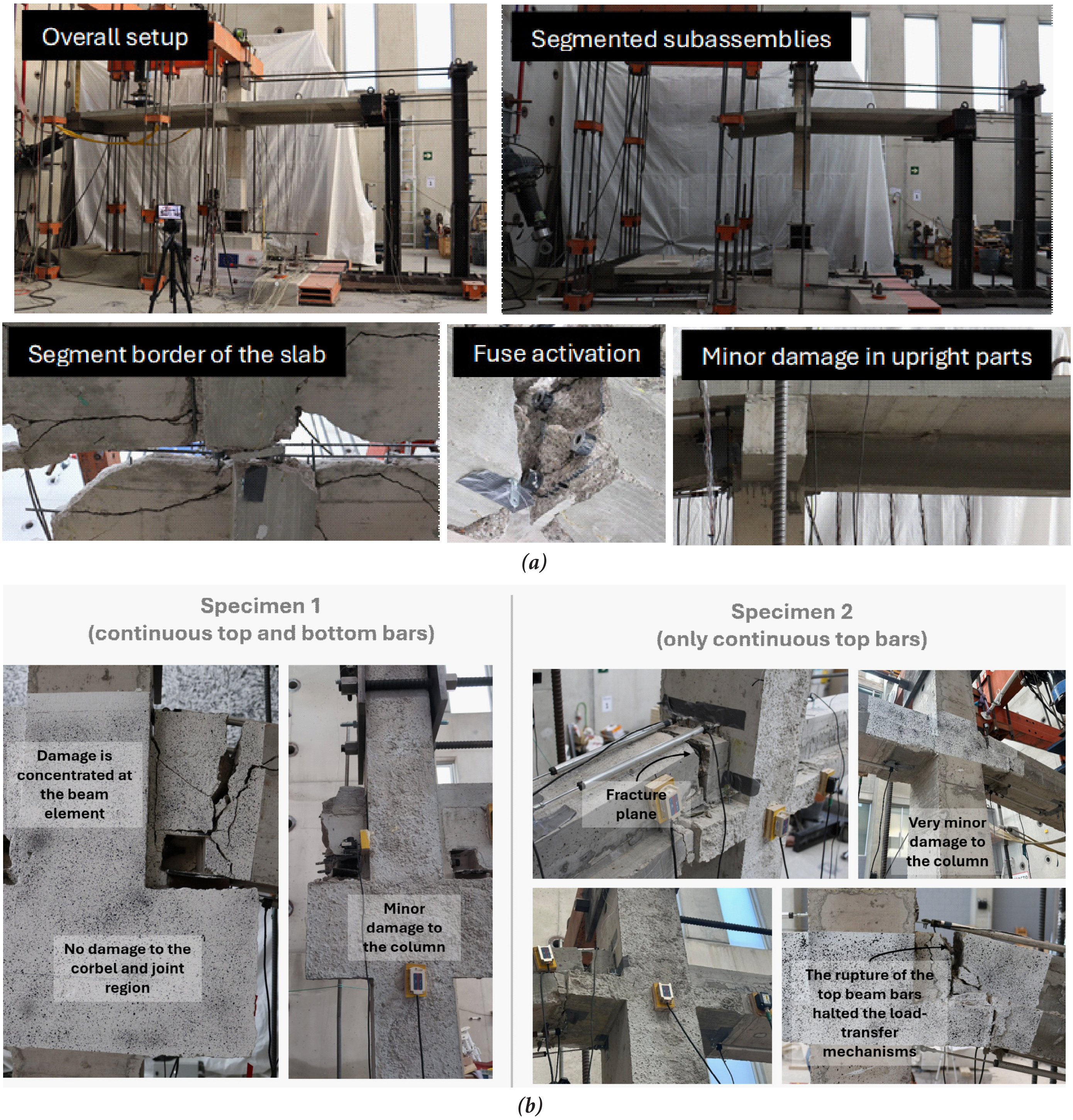
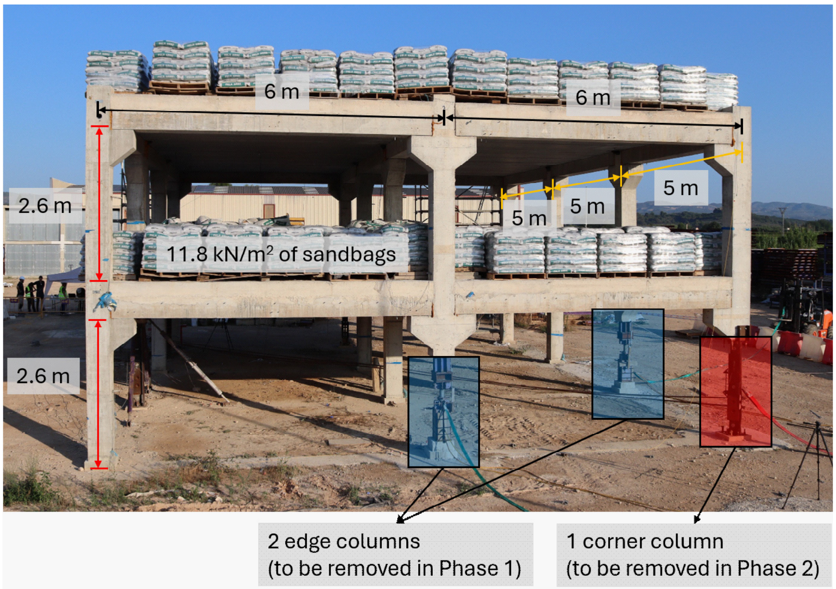


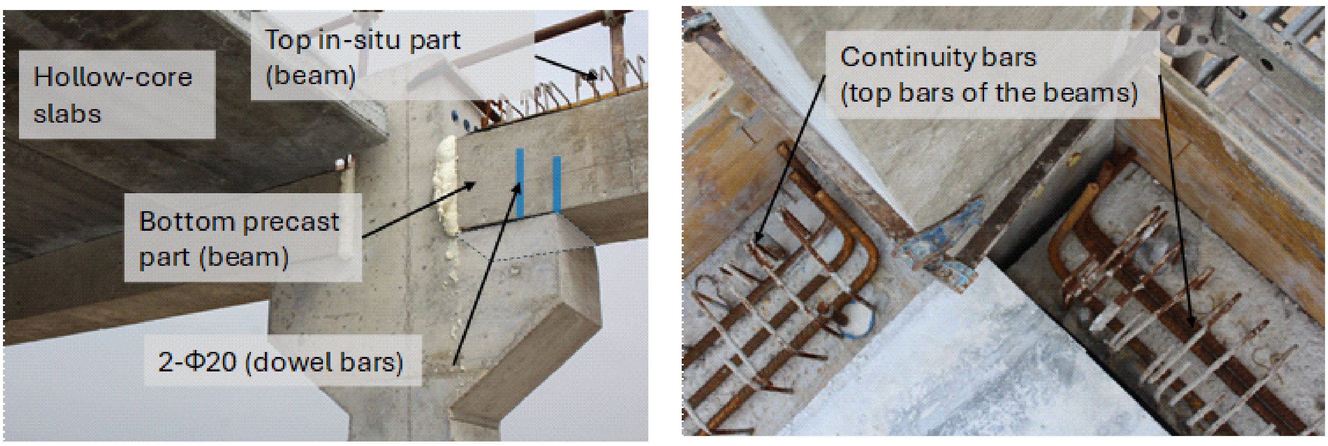
Figure 2: Summary of the subassembly test results: (a) Cast-in-place specimen; (b) Precast specimens.

were installed continuously from one end of the building to the other through splicing (at internal spans). The same bars were connected to anchors (in columns at either end) with mechanical rebar couplers. This detail was adopted to ensure continuity between the internal and perimeter parts of the building, allowing load redistribution in the event of small initial (local) failures that do not lead to collapse propagation. These continuity bars were passed through sleeves prepared explicitly in the precast column at the beam-column connection locations. Elastomeric bearing pads were placed on top of the columns' corbels to provide vertical support to the beams. The bottom side of the beams (the precast part) was connected to the corbels using 2-Ø20 mm dowel bars. The floor slabs were made of hollow-core slabs with a total depth of 26.5 cm (20 cm precast + 6.5 cm topping), a unit width of 1.2 m, and a span of 6 m between the beams. The fuse-based segmentation concept was implemented in the system using a partial-strength beam-column connection, with columns designed to have a capacity greater than the maximum forces the floor system (beam + slab) can transmit. The partial-strength connection (Figure 3b) was designed to provide sufficient continuity to redistribute internal forces after small initial failures while segmenting when exceeding a threshold force (that is predefined), thereby fulfilling the fuse-based segmentation principle. More detailed information about the design of the building specimen is provided by Makoond *et al.* (2024b) and Buitrago *et al.* (2023; 2024; 2025).

Before performing the column-removal process, the building was loaded with more than 8000 sandbags, representing a uniformly distributed load (UDL) of 11.8 kN/m². The sandbags were placed only on the bays adjacent to the removed columns, covering 50% of the total bays (Figure 3a). Preliminary computational simulations indicated that partial loading configurations induce more critical unbalanced forces in the remaining upright parts than the fully loaded configuration. This was reflected in the lateral drift values, which were larger for the partially loaded configuration. This can be explained as, during the collapse process, both vertical and lateral motions are expected to occur. In the fully loaded configuration, the sandbags placed on the remaining uprights provide a counterbalance that stabilises



(a)



(b)

Figure 3: (a) Layout and key geometries of the purpose-built precast specimen (the columns to be removed are also highlighted); (b) The partial strength beam-to-column connection fulfilling the fuse-based segmentation

the building against lateral forces, leading to smaller drifts. To represent the worst unforeseen scenario, we decided to adopt the partially loaded configuration.

The testing protocol was designed in two subsequent loading phases. In the first one, two edge columns were removed (quasi-statically) to represent a small-to-moderate initial failure size, for which continuity is expected to allow the development of alternative load paths, preventing any collapses. This was done by gradually unloading the hydraulic jacks supporting the two columns (shown as blue-shaded boxes in Figure 3a). After the building stabilised, the second testing phase was performed by suddenly removing an additional corner column (refer to the red-shaded box in Figure 3a) located between the two edge columns removed in Phase 1. In total, three columns were removed, representing a large initial failure where segmentation was deliberately designed to occur and prevent the collapse from propagating beyond the initially affected regions.

In Phase 1 of the test, removing the two edge columns did not initiate any further failures (Figure 4a). This validates the building system's ability to redistribute loads from the failed components (two removed columns) to the remaining part of the system through the continuity provided by the beams and floor slabs. The peak vertical displacements measured at the two locations were about 60-70 mm (Figure 4b), equivalent to a chord rotation of about 0.01 – 0.015 radians of the two beams connected to the removed column. This level of rotation can be considered too small to activate effective catenary or tensile membrane action of the slabs. This indicates that the primary resisting mechanism was primarily flexural. Simultaneously, the gravity loads previously supported by the edge columns were redistributed to the adjacent columns as an increased of compressive loads at the penultimate internal column and the corner one. Simultaneously, we noticed that the columns farther from the initial failure were unloaded (compression forces reduced), yet they remained in compression.

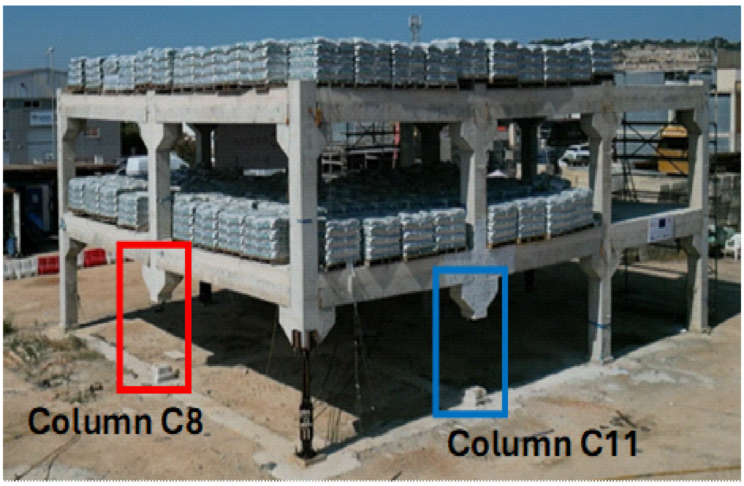
In Phase 2, removing the third (corner) column triggered a partial collapse (the snapshots of the collapse process are shown in Figure 5). However, thanks to the implementation of the newly proposed fuse-based segmentation approach, the collapse front was arrested just at the borders between the initially affected regions (the loaded bays) and the rest of the system. Consequently, the collapse was isolated, and the remaining parts of the building remained intact.

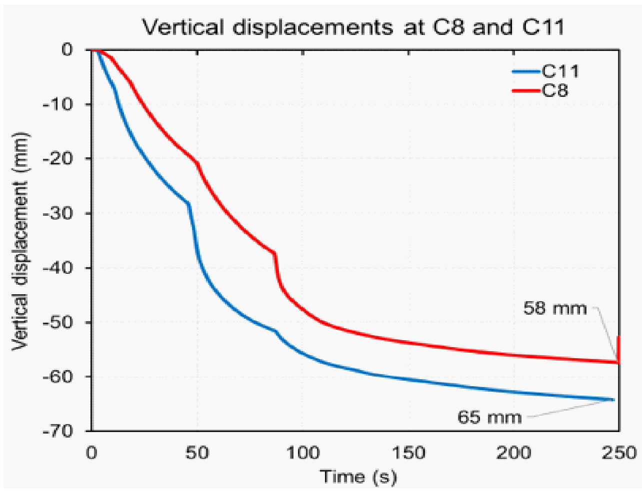
An aerial view of the building specimen following a partial collapse is shown in Figure 6a. The structural segment boundary effectively isolated the sections impacted by the extensive initial damage, preventing the rest of the structure from collapsing. A subsequent post-collapse examination was conducted to analyse the specific failure mechanisms that facilitated this segmentation. As illustrated in Figure 6b, these primary mechanisms included the fracturing of the dowel and top continuity bars at the beam-column joints, along with the debonding of the slab reinforcement mesh due to slippage. Notably, while structural segmentation successfully halted the collapse, the building's remaining upright parts still sustained damage. The observed damage was most severe near the segmentation boundary and gradually decreased with increasing distance from the failure zone; a comprehensive discussion of these post-collapse assessments can be found in Buitrago *et al.* (2024).

4. Lessons Learned from the Project

The article presents the development and, particularly, the experimental validation of the fuse-based segmentation approach to arrest the collapse propagation of buildings. The lessons learned extracted from the work are summarised below:

- Fuse-based segmentation synergistically combines continuity to develop effective alternative load paths after small initial failures and segmentation to isolate the collapse after a large initial failure occurs.
- The first demonstration of the concept was carried out using a new laboratory setup that is capable of





(a) *(b)*

Figure 4: (a) Deformed state of the building specimen after the removal of two edge columns in Phase 1; (b) Vertical deflections at the removed column locations (C8 and C11).

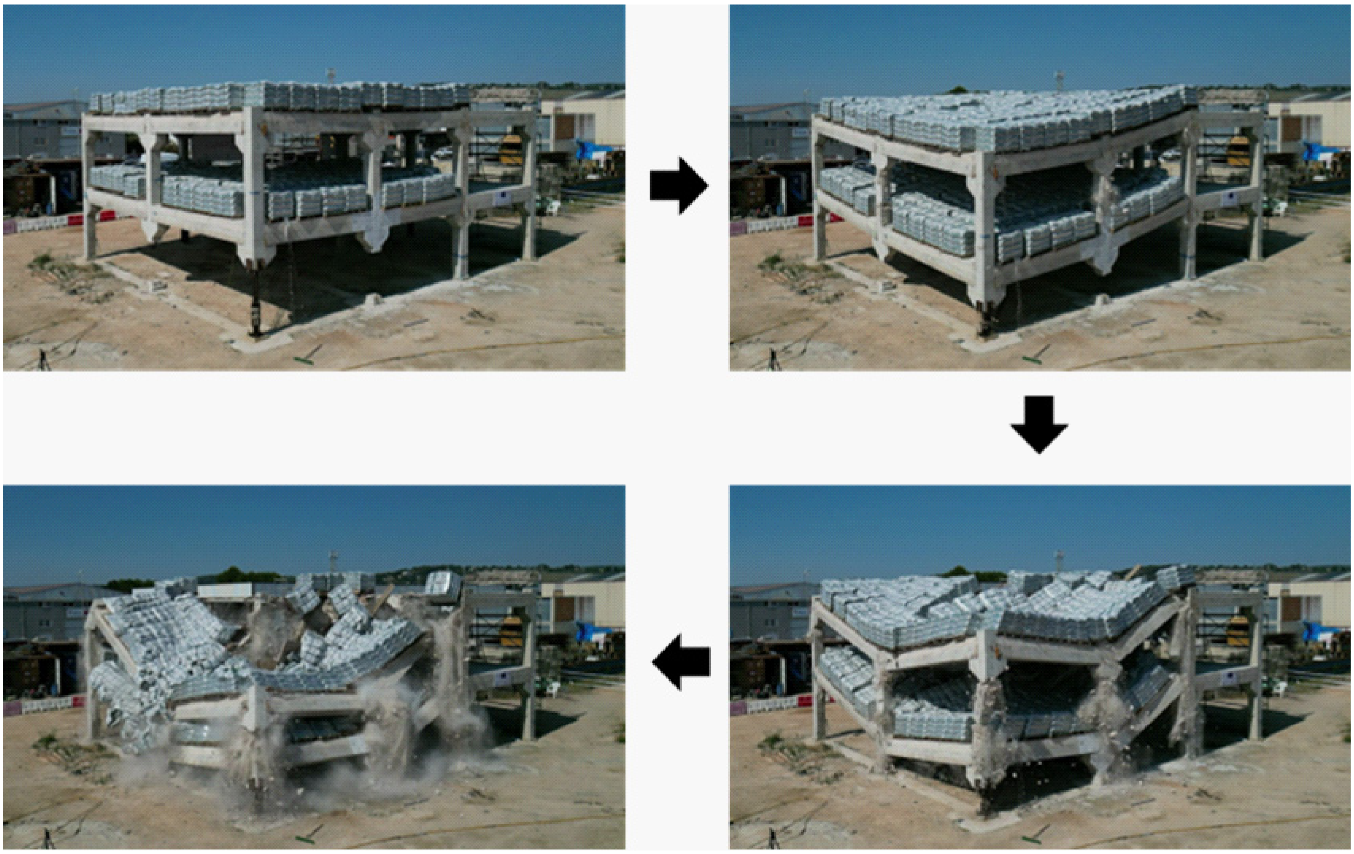
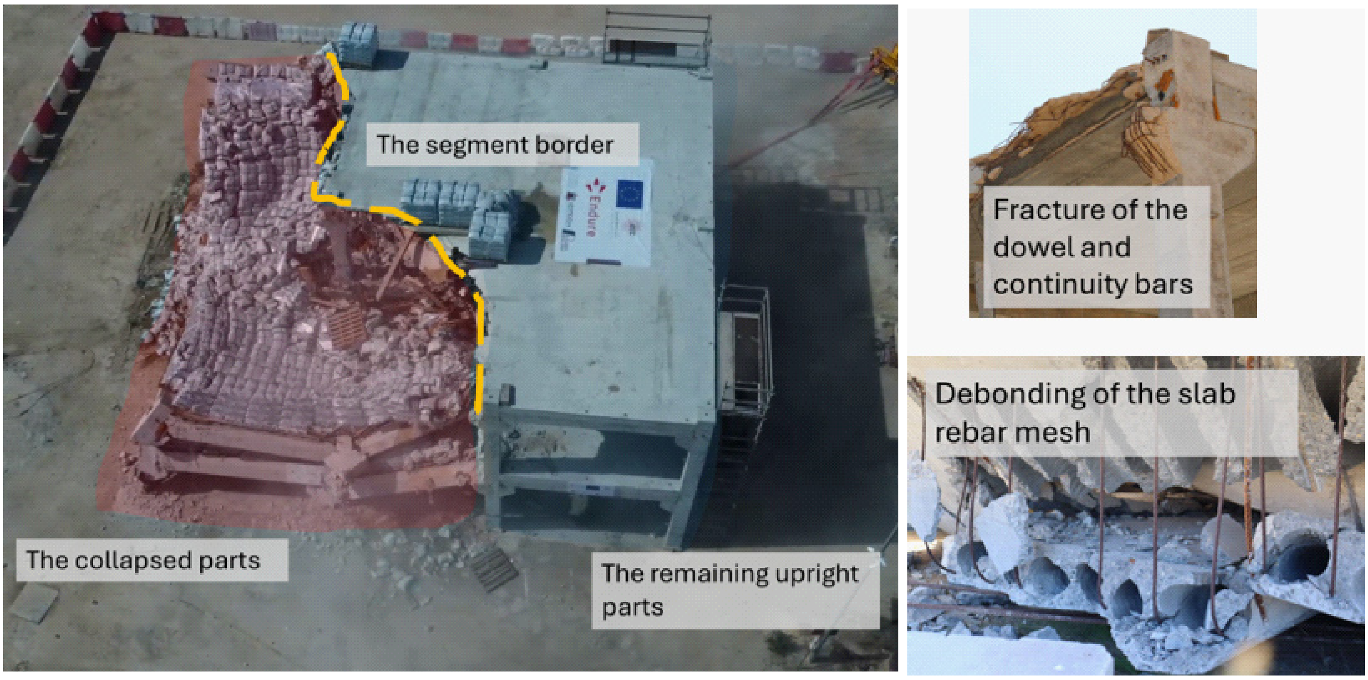


Figure 5: The partial collapse of the precast building specimen during Phase 2.



(a) *(b)*

Figure 6: (a) An aerial view of the building specimen showing the segment border; (b) Key failure mechanisms enabling segmentation to arrest collapse propagation.

simulating system-level collapse propagation. Based on the subassembly tests, it was demonstrated that failure propagation can be arrested by engineering a specific hierarchy of element failures. This was hieved by introducing a structural fuse in the cast-in-place building and by reducing the top longitudinal bars in the precast system so that the horizontal members (beams and floor slabs) failed earlier before the column.

- The concept was further validated against a purposely-built precast building specimen. The building system uses partial-strength beam-column connections that limit force transfer from the floor systems to the columns during collapse, protecting the columns from severe damage. A two-phase testing programme was adopted to assess the building system's ability to redistribute loads under a small-to-moderate failure and to arrest collapse under a larger failure. In Phase 1, thanks to the continuity provided by ties and the dowel bars in the beam-column connection, alternative load paths can develop effectively, redistributing loads from the failed elements to their surroundings. In Phase 2, the force went beyond the threshold, and the dowel bars broke, followed by the fracture of the top longitudinal bars, isolating the initially collapsed regions from the rest of the building. Although the remaining upright parts were damaged during the process, safe evacuation can still be carried out, minimising loss of life during such extreme events.

5. Acknowledgements

The works presented here are funded by the European Research Council (ERC) through the ENDURE project under the European Union's Horizon 2020 research and innovation programme (Grant Agreement No. 101000396) and the Proof-of-Concept ENCAST project (Grant No. 101188699). The authors would also like to acknowledge the support of all members of the Building Resilient group at ICITECH, Universitat Politècnica de València.

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Summary of SECED 2026 Annual General Meeting

Damian Grant
Immediate Past Chair

On Wednesday 29th April this year, it was my pleasure to chair SECED's Annual General Meeting. As per our usual AGMs, the main items on the agenda were a report from our outgoing Treasurer, Brian Young, and my Chair's report. Brian noted that with increasing costs, in large part due to a reduction in the support we receive from the ICE, the SECED committee had elected to increase our subscription rates by approximately 4% in 2027. Given the high inflation in recent years, and the fact that we did not increase rates in 2026, we feel the new rates still represent excellent value for our members.

In my Chair's report, I summarised SECED events since the last AGM, including technical meetings, activities by our Young Members Sub-committee (the podcast, SECED fund, the newsletter), the TK Hsieh prize, and my absolute highlight as SECED Chair: Professor Michele Calvi's Mallet-Milne lecture from May 2025. I also revealed the results of the SECED Committee election, in which ten nominations had been received for an unprecedented six vacant posts. We welcome a mix of new and returning faces to the Committee: Orestis Adamidis, Umut Akguzel, Mariana Asinari, Manuela Daví, Fabio Freddi and Maria Liapopoulou.

Finally, perhaps the most important item for this year's AGM was a resolution for SECED to incorporate as a not-for-profit Company Limited by Guarantee (CLG). This resolution was proposed by the Committee on the basis of several years' investigation and independent legal advice. I reported that the main reasons to incorporate was to allow SECED to exist as a legal entity distinct from its members, to allow us to sign contracts on behalf of the society (rather than on an individual basis), and so that committee members' liability for SECED's activities are reduced. This resolution passed unanimously, and the Committee has therefore started with the process of incorporation as a CLG.

Following the AGM, we welcomed past Chairs Professor Ahmed Elghazouli and Ziggy Lubkowski to present on upcoming changes in the new Eurocode 8, and its implication for seismic design in the UK. This was an excellent – and impactful – presentation, and we hope to hear more from the speakers in a written contribution to a future issue of the newsletter.

The AGM was officially my last act as Chair of the SECED Management Committee and I have now handed over the reins to Dr Barnali Ghosh, who will serve as Chair for the next two years. I wish her the best of luck in the role, and I will of course continue to support her as Immediate Past Chair.

SECED Fund 2026

The SECED Fund 2026 is now open for applications. The scheme offers awards of up to **£1,500** to individuals or teams seeking to further their studies, research, career development, or voluntary activities in the field of engineering dynamics. The fund may support a wide range of relevant activities, including laboratory or field experiments, the development of engineering tools or open-source software, site visits, field trips, post disaster missions, attendance at Continuing Professional Development events, workshops or conferences, and the organisation of events related to engineering dynamics. Applicants must hold a valid SECED membership. Applications are welcome from all nationalities, with no restrictions on academic or employment status, and no age limits. SECED Young Members are strongly encouraged to apply.

The application deadline is **31 July 2026.** Further information is available at: https://www.seced.org.uk/index.php/young-seced/seced-fund

SOCIETY FOR EARTHQUAKE & CIVIL ENGINEERING DYNAMICS (SECED)
an associated society of the Institution of Civil Engineers

SECED Fund 2026

Applications for an award of up to £1,500 will be considered.

Who can apply?

- Individuals or teams who are seeking to further their studies, research, or career in the field of engineering dynamics, and/or are undertaking a project that will promote or lead to advances in this field.
- Applicants of all nationalities with a valid SECED membership; there are no restrictions on academic or employment status, and no age limits.

Application deadline: 31 July 2026

SECED Site Visit to Servotest

On 11 June 2026, SECED members attended a technical site visit to Servotest Testing Systems Ltd in Egham, Surrey. The event provided a valuable opportunity for members to gain insight into the development and application of advanced servo-hydraulic testing and simulation systems.

The visit began with a guided tour of Servotest's facilities, where participants observed the design, manufacture, and operation of bespoke testing systems used across a range of sectors, including civil engineering and automotive applications. Servotest is particularly recognised for its work in seismic simulation and structural testing, supporting research and development in earthquake engineering and structural resilience.

Following the tour, attendees enjoyed a technical presentation delivered by Darren Burke, who provided an overview of Servotest's work in seismic simulation, large-scale structural testing, and automotive testing systems. The presentation generated engaging discussions and offered valuable insights into the practical challenges and innovations involved in advanced testing and simulation.

The visit concluded with members gathering for informal networking drinks near Egham railway station, providing attendees with a further opportunity to discuss the day's activities. The visit was very well received, and SECED extends its sincere thanks to the entire Servotest team for their warm hospitality and for sharing their expertise with our members.



Notable Earthquakes January 2026 – April 2026

Reported by British Geological Survey

Issued by: Davie Galloway, British Geological Survey, June 2026.
Non British Earthquake Data supplied by: United States Geological Survey.

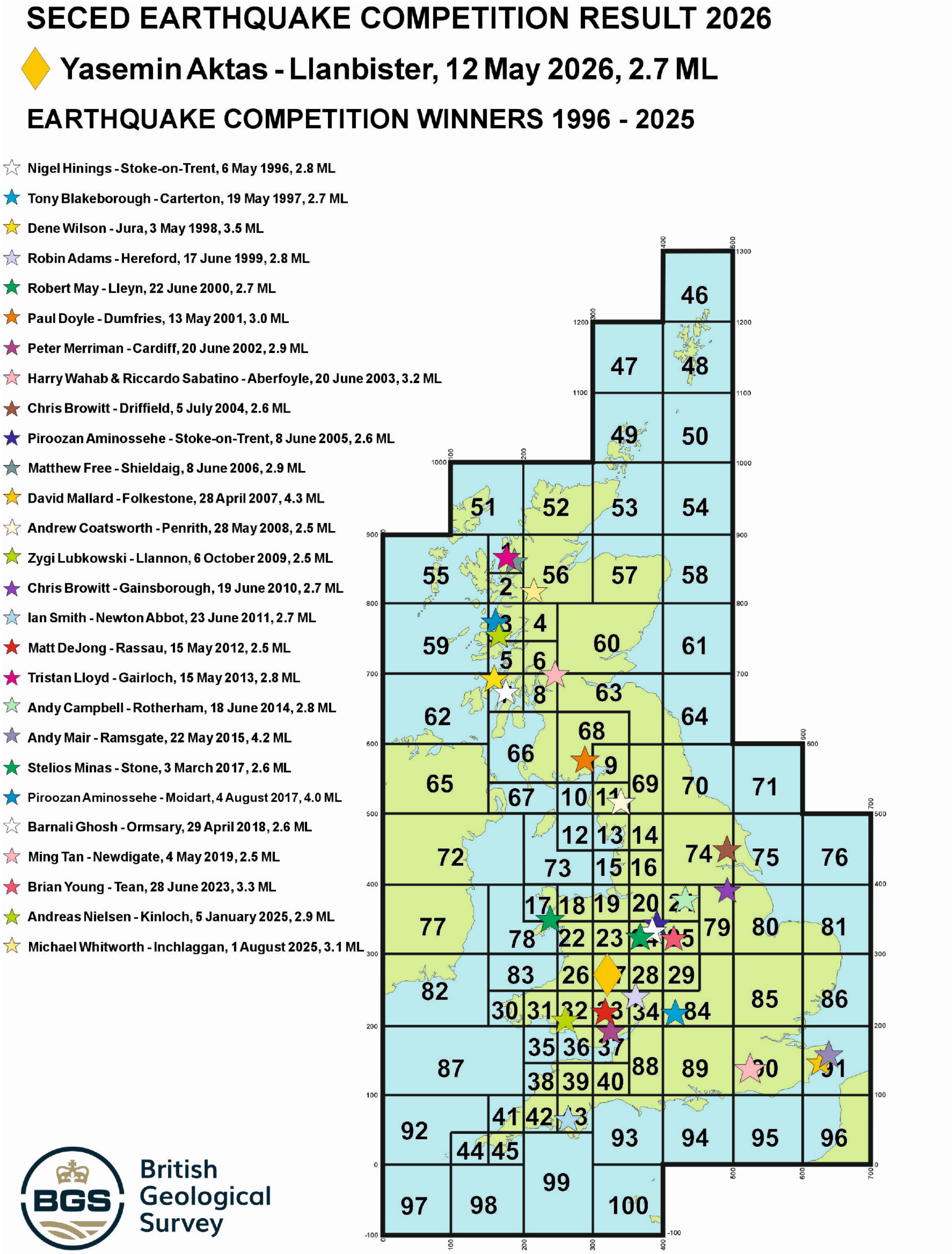
			Time			Dep	Magnitude			
Year	Day	Mon	UTC	Lat	Lon	km	ML	Mb	Mw	Location
2026	02	JAN	13:58	16.80N	99.39W	18			6.5	GUERRERO, MEXICO
Two people were killed, 24 others were injured and over 70 homes were destroyed and another 5,310 were damaged in Guerrero and Mexico City.										
2026	03	JAN	02:34	50.85N	0.22E	8	1.6			HAILSHAM, EAST SUSSEX
2026	04	JAN	15:22	56.76N	5.73W	8	1.6			ACHARACLE, HIGHLAND
Felt Acharacle (2 EMS).										
2026	12	JAN	06:08	53.18N	2.56W	12	1.7			WINSFORD, CHESHIRE
2026	18	JAN	12:24	58.90N	1.33E	21	2.3			NORTHERN NORTH SEA
2026	30	JAN	17:34	54.71N	3.09W	6	1.6			CALDBECK, CUMBRIA
2026	31	JAN	00:44	51.88N	4.32W	5	1.5			BRONWYDD, CARMARTH
2026	08	FEB	15:04	50.86N	2.93W	8	2.0			CHARD, SOMERSET
2026	10	FEB	02:10	54.19N	2.82W	4	1.2			SILVERDALE, LANCASHIRE
Felt Silverdale, Arnside and Carnforth (3 EMS).										

Year	Day	Mon	Time UTC	Lat	Lon	Dep km	Magnitude ML	Mb	Mw	Location
2026	16	FEB	21:43	56.41N	4.43W	3	1.3			BALQUHIDDER, STIRLING
Felt Crianlarich (2 EMS).										
2026	22	FEB	10:25	54.16N	2.83W	3	1.4			SILVERDALE, LANCASHIRE
Felt Silverdale and Arnside (3 EMS).										
2026	22	FEB	16:57	6.85N	116.29E	629			7.1	SABAH, MALAYSIA
2026	28	FEB	06:44	56.54N	4.56W	3	1.7			PUBIL, PERTH & KINROSS
2026	02	MAR	21:10	54.16N	2.83W	4	1.1			SILVERDALE, LANCASHIRE
Felt Silverdale and Arnside (3 EMS).										
2026	09	MAR	19:25	56.55N	4.55W	3	2.8			PUBIL, PERTH & KINROSS
Felt Pitlochry, Kinloch Rannoch and Aberfeldy (3 EMS).										
2026	11	MAR	01:33	53.34N	1.49E	7	2.4			SOUTHERN NORTH SEA
2026	20	MAR	00:22	61.19S	56.40W	21			6.5	SOUTH SHETLAND ISLANDS
2026	21	MAR	12:16	23.86N	45.80W	10			6.6	NORTH ATLANTIC OCEAN
2026	21	MAR	20:39	53.36N	4.71W	5	1.2			IRISH SEA
Felt Holyhead (2 EMS).										
2026	22	MAR	17:23	55.99N	5.25W	8	1.8			GLENDARUEL, ARGYLL & BUTE
2026	24	MAR	04:37	18.54S	175.48W	234			7.5	TONGA ISLANDS
2026	26	MAR	14:18	39.44N	143.38E	16			6.5	OFFSHORE HONSHU, JAPAN
2026	30	MAR	08:44	15.29S	167.58E	120			7.3	VANUATU
2026	01	APR	22:44	1.09N	126.24E	35			7.4	MOLUCCA SEA
One person was killed, four others were injured and over 450 buildings were damaged or destroyed, the majority of which occurred in the Batang Dua Island. A tsunami with a maximum wave height of 75 cm was generated.										
2026	03	APR	16:12	36.54N	70.82E	188			5.8	HINDU KUSH, AFGHANISTAN
At least 12 people killed, six others injured and around 40 homes either destroyed or damaged across six provinces in Afghanistan.										
2026	15	APR	15:55	56.54N	4.59W	7	2.3			PUBIL, PERTH & KINROSS
2026	16	APR	19:46	56.53N	4.58W	3	3.3			PUBIL, PERTH & KINROSS
Felt Pitlochry, Kinloch Rannoch, Bridge of Orchy and surrounding villages (3 EMS).										
2026	17	APR	00:57	56.54N	4.55W	3	1.7			PUBIL, PERTH & KINROSS
2026	17	APR	04:46	56.52N	4.58W	4	1.6			PUBIL, PERTH & KINROSS
2026	17	APR	17:30	50.14N	2.24W	5	1.5			ENGLISH CHANNEL
2026	20	APR	07:52	39.97N	143.06E	25			7.4	OFFSHORE HONSHU, JAPAN
At least 10 people injured and over 230 buildings damaged in Iwate and Hokkaido. A tsunami with a maximum wave height of 80 cm was generated.										
2026	20	APR	13:22	54.29N	2.48W	8	1.8			DENT, CUMBRIA
2026	27	APR	00:52	51.33N	2.33W	14	1.8			BATH, SOMERSET

SECED Earthquake Competition Result 2026

The SECED Earthquake Competition, organised by SECED since 1996, seeks to forecast the location of the next earthquake in Britain with a magnitude of at least 2.5 ML. Participants use their understnading of british historical seismicity, combined with an element of chance, to predict where the next significant earthquake will occur, choosing a location from the grid shown in the figure below.

The 2026 winner is Yasemin Aktas, who accurately predicted a 2.7 ML earthquake in Llanbister. This earthquake occured on Tuesday 12th May 2026.



SECED Earthquake Competition Winners, 1996-2026.

The Twentieth Mallet-Milne Lecture

Ellen M. Rathje

The Evolution of Site Response Analysis: Where we have been and where are we

Institution of Civil Engineers
Also broadcast online
26 May 2027

Introduction

We are delighted to announce that Professor Ellen M. Rathje has accepted the invitation by the SECED Committee to deliver the 20th Mallet-Milne Lecture next year. As with previous Mallet-Milne lecture nominees, this recognises Prof Rathje's wide contributions to earthquake engineering theory, practice and education. The 20th Mallet-Milne lecture will be delivered in the ICE Headquarters in Westminster, London, on the 26th of May 2027.

Synopsis

Local soil conditions can dramatically amplify — or in some cases attenuate — the ground shaking that reaches a structure during an earthquake. For more than five decades, one-dimensional (1D) site response analysis has been the foundational tool for simulating these effects, and it remains central to seismic design practice today. Yet the method has evolved substantially, and understanding this evolution is essential for anyone who relies on site response results for seismic hazard assessments, design ground motions, or performance-based evaluations.

This lecture traces that evolution through the lens of Prof. Rathje's extensive experience on seismic hazard projects for nuclear facilities — a context that demands exceptional rigour, transparency, and defensibility, and one that has consistently pushed the boundaries of engineering practice. The lecture traces the developments that span the full arc of site response analysis, from advances in small-strain site characterisation (shear wave velocity, damping, and HVSR measurements) to improved approaches for modeling large-strain behaviour. It also examines the role of Random Vibration Theory (RVT), which enables robust analyses without the need for input ground motion time histories, as well as emerging methods for quantifying parametric uncertainty in key model inputs.

The practical role of open-source tools — particularly strata and the Python-based pystrata — is highlighted, demonstrating how these platforms have made advanced analysis methods more accessible to practicing engineers. The lecture concludes with a forward-looking discussion of the field's priorities, including the need for broader validation across diverse site conditions and shaking intensities, and the challenges associated with incorporating multi-dimensional site response effects.

For further information about the Mallet-Milne Lecture, SECED's biennial prestige lecture, and its previous awardees, please see here.

Biography

Dr. Ellen M. Rathje is the Janet S. Cockrell Centennial Chair in Engineering in the Fariborz Maseeh Department of Civil, Architectural, and Environmental Engineering and a Senior Research Fellow at the Bureau of Economic Geology at the University of Texas at Austin. She is an expert in the areas of engineering seismology, seismic ground response, and earthquake-induced ground failure.

Dr. Rathje is the current President of the Earthquake Engineering Research Institute and she is a founding member and previous Co-Chair of the Geotechnical Extreme Events Reconnaissance (GEER) Association. She leads the DesignSafe cyberinfrastructure that supports research in natural hazards engineering. Her awards include the 2022 Peck Lecture Award from the ASCE Geo-Institute, the 2018 William B. Joyner Lecture Award from the Seismological Society of America and the Earthquake Engineering Research Institute, and election to the National Academy of Engineering in 2025.

Further information

Further information will be published in due course at the event link here.

Announcing the SECED 2027 Conference

Engineering for a Dynamic Future

Bristol 2027

SECED

8-9 July 2027 in Bristol

Chairs:
Flavia De Luca
Christian Málaga-Chuquitaype
Fabio Freddi

Overview

The Society for Earthquake and Civil Engineering Dynamics (SECED) is delighted to announce the SECED 2027 Conference. This two-day conference, entitled Engineering for a Dynamic Future, will take place on 8–9 July 2027 in Bristol, UK. The conference will be held at the new Temple Quarter University of Bristol campus. Easy to reach from the main station of Bristol Temple Meads, this premium space will be the ideal space for our conference. As part of the conference organisation attendees will have the opportunity to visit the UKCRIC Soil-Foundation-Structure-Interaction Laboratory (https://sofsi.bristol.ac.uk/) including the new 6 m × 4 m biaxial shaking table with a 50 t capacity and the 6 m × 5 m test soil pit. The conference dinner will be held at the Great Hall on Thursday evening within the iconic Wills Memorial Building

The 2027 Conference follows in the footsteps of the hugely successful 2023 Conference, which was held in Cambridge. Hosted in one of the UK's most vibrant and innovative cities, the SECED 2027 Conference will provide a unique forum for researchers, engineers, practitioners, and policymakers from across academia, industry, and government to come together and exchange ideas on the latest developments in earthquake engineering and structural dynamics. The event will offer an engaging and collaborative environment, fostering dialogue on the challenges and opportunities associated with designing infrastructure for an increasingly dynamic and uncertain world.

For over 50 years, since its establishment in 1969, SECED has provided a focal point for the advancement and dissemination of knowledge in the fields of earthquake and civil engineering dynamics. Held every four years, the SECED conference is a flagship event for the community, bringing together leading international experts alongside early-career researchers to showcase cutting-edge research, share practical innovations, and shape the future direction of the discipline.

The 2027 conference will cover a broad and evolving spectrum of topics reflecting the multidisciplinary nature of the field. Themes will include, but are not limited to, seismic hazard and engineering seismology; geotechnical earthquake engineering; structural dynamics and vibrations; blast and impact loading; seismic assessment, retrofit and strengthening of engineered and non-engineered structures; performance-based and resilience-based design; advances in numerical modelling, experimental techniques and data-driven methods; applications of artificial intelligence in earthquake engineering and dynamics; infrastructure resilience and sustainability; seismic design for nuclear and critical facilities; risk, reliability and catastrophe modelling; earthquake reconnaissance and field investigations; and the societal dimensions of earthquakes, including community resilience, policy, and recovery.

Particular emphasis will be placed on emerging challenges such as climate-driven multi-hazard scenarios, the integration of new materials and construction technologies, digitalisation in engineering practice, and the role of engineering in supporting sustainable and resilient communities worldwide. The conference aims to encourage interdisciplinary perspectives and to bridge the gap between research and practice.

The Great Hall in the Wills Memorial Building.

SECED

SECED, The Society for Earthquake and Civil Engineering Dynamics, is the UK national section of the International and European Associations for Earthquake Engineering and is an Associated Society of the Institution of Civil Engineers. It is also sponsored by the Institution of Mechanical Engineers, the Institution of Structural Engineers, and the Geological Society. The Society is also closely associated with the UK Earthquake Engineering Field Investigation Team. The objective of the Society is to promote co-operation in the advancement of knowledge in the fields of earthquake engineering and civil engineering dynamics including blast, impact and other vibration problems.

SECED Newsletter

The SECED Newsletter is published quarterly. All contributions of relevance to the members of the Society are welcome. Manuscripts should be sent by email. Diagrams, pictures and text should be attached in separate electronic files. Hand-drawn diagrams should be scanned in high resolution so as to be suitable for digital reproduction. Photographs should likewise be submitted in high resolution. Colour images are welcome. Previous issues of the SECED Newsletter are available online. Please contact the Editor of the Newsletter, Fabio Freddi, for further details. This edition of the Newsletter was co-edited by Ashraf G. Nayel, Atif Rasheed, and Milindu Jayasekara.

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