MetaInfrastructure.org

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Issue: 04

# NEWSLETTER

## our mission

We innovate for delivering future built ecosystems — encompassing cities, infrastructure, buildings, and services—through people-centric, sustainable, and resilient design. Our work supports equitable infrastructure aligned with the UN SDGs and Net-Zero goals. We assess the exposure of cyber-physical infrastructure to natural, climate, and anthropogenic threats—from sea-level rise to conflicts—using threat-agnostic resilience approaches. Leveraging AI, Generative Design, Digital Twins, IoT, and VR, we develop data-driven solutions to enhance decision-making in complex systems.

Our research promotes sustainability, inclusivity, and co-development, shaping green and blue infrastructure policies within the evolving metaCity. Through Counterfactual Engineering and Engineering for People, we explore innovative strategies to future-proof infrastructure—upholding the core mission of Civil Engineering: serving society by delivering safe, inclusive, and resilient infrastructure that enables communities to thrive.

## top news

Nadiia Kopiika, a member of the MetaInfrastructure community, received the Verkhovna Rada of Ukraine Prize for Young Scientists, recognising outstanding scientific achievements and contributions to Ukraine's research capacity. The award was presented by Ruslan Stefanchuk during an official ceremony.

The PORTAL Project (Threat-Agnostic Resilience of City Ports) was officially launched with a kick-off meeting at County Hall. Coordinated by Brunel University of London, the 48-month Marie Skłodowska-Curie Actions Staff Exchange project brings together academic and industry partners from Europe and the United States to advance resilience and adaptation strategies for city-port ecosystems.

# our expertise

### threat-agnostic resilience

- Real-time, resilience-based response framework and metrics
- AI-driven integration and digital twin technology
- Automated decision support systems for complex infrastructure systems
- Proactive mitigation of cascading failures

### AI applications & digitalisation

- Advanced data integration and analysis
- Innovative monitoring and predictive technologies
- AI-driven digital twins for infrastructure
- Ethical and explainable AI for crisis management

### sustainable development


- Comprehensive Life Cycle Assessment (LCA) frameworks
- Predictive and risk-integrated models
- Multi-criteria optimisation for circularity
- Time-dependent circular intervention planning

### metaCity

- Resilient urban systems
- Coupled urban risk mitigation
- Innovative technologies for smart cities
- Sustainable and equitable urban environments

### Counterfactual Engineering

- Hazard intensity assessment
- Fragility and recovery modeling
- Sustainability analysis
- Resilience quantification and cost assessment
- Resilience and sustainability trade-offs

### engineering4people

- Integrated people-centric risk models
- Data-driven calibration
- People-centric strategies

- Education & capacity building
- Massive Open Online Courses
- Continuous Professional Development (CPD)

# featured topic – Future Cities Journal: Emerald Publishing

## MetaInfrastructure members lead new journal Future Cities

Future Cities is a multidisciplinary journal addressing the interconnected challenges shaping urban environments in the coming decades. As cities accommodate a growing share of the global population, rapid advances in AI, big data, and the Internet of Things are transforming urban systems into increasingly smart, interconnected, and complex environments. At the same time, cities face escalating pressures from climate change, environmental degradation, resource insecurity, conflict-related hazards, and widening social and economic inequalities.

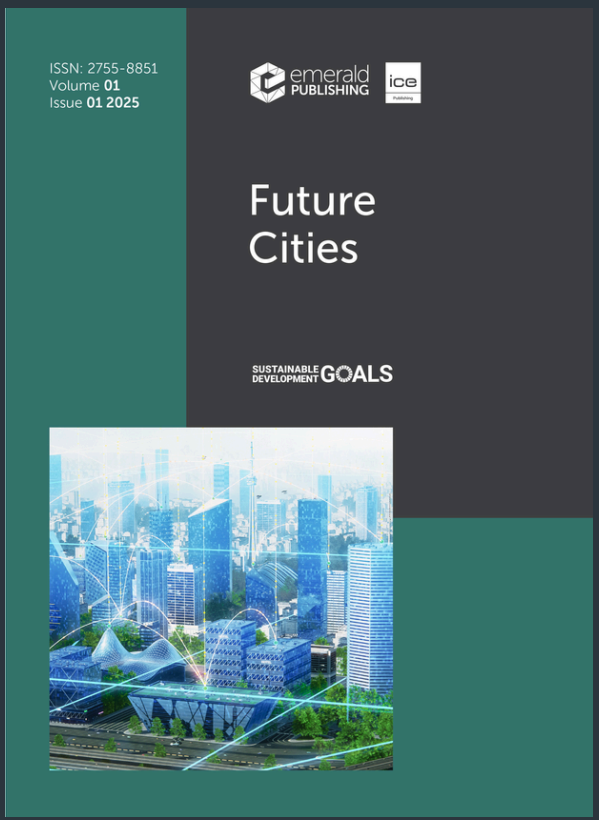
Members of MetaInfrastructure are leading Future Cities Journal, published by Emerald Publishing and officially launched in October 2025. The journal provides a multidisciplinary platform for research addressing the complex, interconnected challenges shaping cities and infrastructure systems in the coming decades.

**Key Topics**

- Urban resilience
- Sustainable urban development and circularity
- Urban management and governance
- Sustainable and resilient infrastructure
- People-centric, inclusive, and participatory urbanism
- Digitalisation and smart technologies in cities
- Climate change and cities
- Speculative and visionary urban futures (cross-cutting)

The journal is now open for submissions and welcomes interdisciplinary contributions from engineering, planning, digital technologies, social sciences, climate science, and related fields.

🔗 Learn more and submit your work:
https://www.emeraldgrouppublishing.com/journal/fc




**Editor-in-Chief**
Professor Stergios-Aristoteles Mitoulis
The Bartlett School of Sustainable Construction,
University College London - UK

**Editorial Communications Lead**
Roberta Di Bari
University College London - UK

**Editorial Advisory Board**
Dr Sotirios Argyroudis
Brunel University of London - UK
Dr Nadiia Kopiika
Lviv Polytechnic National University - Ukraine

# featured topic - publication in Nature Communications

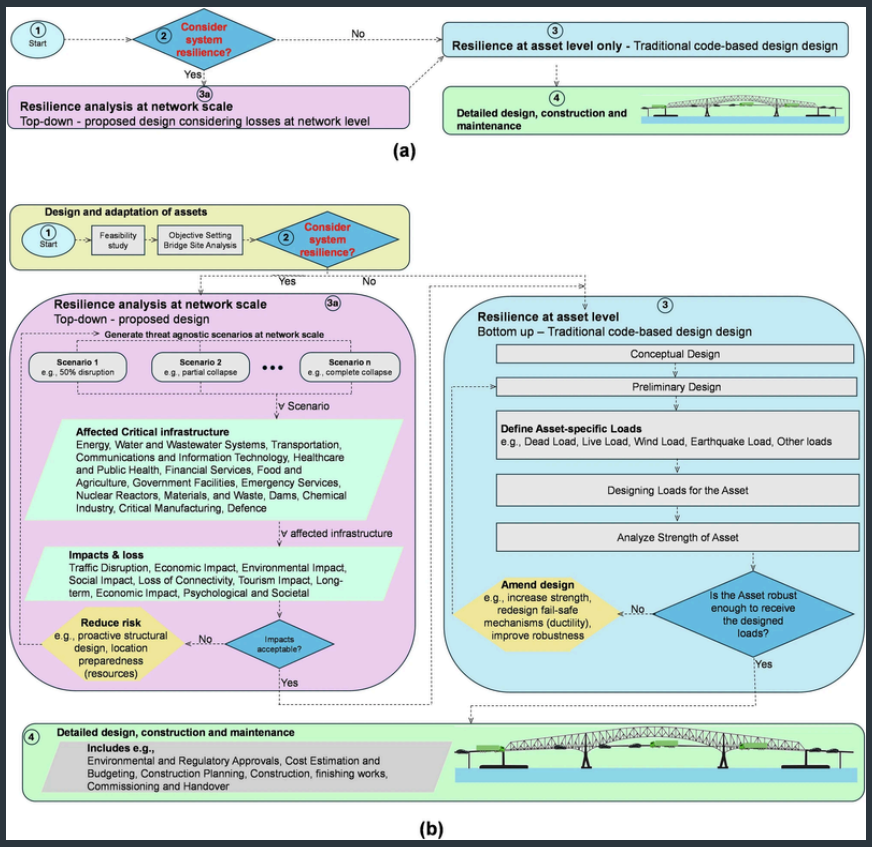
## Rethinking infrastructure design from component failure to systemic resilience

Professor Stergios Mitoulis from The Bartlett School of Sustainable Construction (BSSC) at UCL has co-authored an international study published in Nature Communications, developing a resilience-based design framework that challenges conventional approaches to the design and management of critical infrastructure within interconnected infrastructure systems.

Co-written by Sam Dulin, Alexandre Bredikhin, Eric Treyz, Billy Leung, Jeffrey Dykes, Owen Karpeles, Shreeya Gurav, Alex Karhunen and Igor Linkov; the research used the collapse of the Francis Scott Key Bridge in Baltimore as a case study to illustrate how the failure of a single structure can set off chain reactions, disrupting transport networks, supply chains, and regional economies. Through advanced modelling with the REMI TranSight platform, the team quantified the wider economic consequences, projecting substantial losses in GDP, employment, and income. In severe scenarios, the study found that full recovery could take until 2040.

The findings urge a shift in focus from traditional risk-based design to resilience-based planning, providing policymakers and infrastructure managers with new tools to anticipate and mitigate systemic impacts. The work was the result of close international collaboration, bringing together experts from the US Army Engineer Research and Development Center, Credere Associates, the US Army Corps of Engineers, and Regional Economic Models Inc.

By highlighting the societal and economic costs of infrastructure failures, the study underscores BSSC's role in pioneering research on resilience and UCL's wider commitment to addressing global challenges through interdisciplinary action. The evidence generated provides decision-makers with a framework to strengthen policy, guide investments, and update design standards, ultimately supporting more sustainable and resilient infrastructure worldwide.




DOI: https://doi.org/10.1038/s41467-025-64683-6

# **our news** Oct-Dec 2025


Decemeber, 2025: Ivan Izonin joined UCL Bartlett School of Sustainable Construction, marking a significant milestone in strengthening AI research for the built environment. A leading AI researcher from Ukraine and a member of MetaInfrastructure since 2023, Prof Izonin's transition to UCL supports the expansion of AI-driven innovation in construction and resilient, sustainable infrastructure across cityscapes. His appointment reinforces UCL Bartlett's global leadership in connecting cutting-edge artificial intelligence methods with real-world challenges in construction and infrastructure systems.

December, 2025: Nadiia Kopiika, a member of the MetaInfrastructure community was awarded the Verkhovna Rada of Ukraine Prize for Young Scientists, recognising outstanding scientific achievements and contributions to the advancement of Ukraine's research capacity. The award was presented during an official ceremony by Ruslan Stefanchuk, highlighting the importance of scientific excellence and innovation in strengthening the country's academic and research ecosystem.


5 December, 2025: The PORTAL Project (Threat-Agnostic Resilience of City Ports) was officially launched with a kick-off meeting held at County Hall in Central London. Coordinated by Brunel University of London, PORTAL is a 48-month Marie Skłodowska-Curie Actions Staff Exchange project developing an innovative, threat-agnostic resilience and adaptation framework for city-port infrastructure and their interdependent socio-ecological systems. The meeting brought together academic and industry partners from Europe and the United States, marking the start of a collaborative effort to establish resilience benchmarks and proactive adaptation strategies for port-city ecosystems.

28 November, 2025: MetaInfrastructure.org hosted a hybrid workshop at UCL, bringing together more than 20 researchers and international collaborators working on resilient, sustainable, and digital infrastructure. The event highlighted the group's growing portfolio of over 15 active research projects across the UK, Europe, and internationally, as well as high-impact publications and advances in digital twins, climate resilience, smart cities, and sustainable construction. Invited talks by Natalya Shakhovska (Lviv Polytechnic National University) and Xinzheng Lu (Tsinghua University) reinforced MetaInfrastructure's strong global engagement and collaborative focus.

# **our news** Oct-Dec 2025


November, 2025: Raffaele Cucuzza began his Marie Skłodowska-Curie Actions Global Fellowship at the UCL Bartlett School of Sustainable Construction. His project, REACT (Reusing steel for Emission reduction through an AI-driven Cutting-stock Tool), advances AI-enabled optimisation to support steel reuse and circular, low-carbon construction. The fellowship strengthens UCL Bartlett's strategic focus on digital innovation, sustainability, and globally connected research in AI for the built environment.

November, 2025: Margaret Sackey, Chair of the Institution of Civil Engineers and Capital Projects Health & Safety Manager at UCL, delivered a guest lecture in the MEng Construction Engineering, Innovation & Leadership (CEIL) programme. Her talk focused on life-cycle thinking and project safety management, demonstrating how safety-in-design principles, fire strategy, procurement, cost, legal and regulatory considerations must be embedded throughout the entire building life cycle, from concept and delivery to operation. The lecture provided students with valuable, practice-based insights linking engineering design with real-world safety and governance requirements..

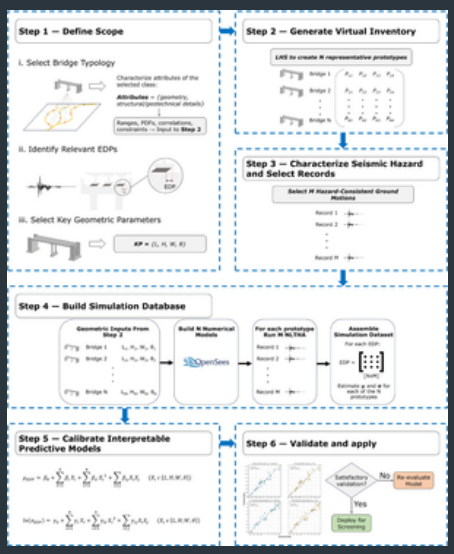

November, 2025: The paper "Seismic Resilience of Interdependent Built Environment for Integrating Structural Health Monitoring and Emerging Technologies in Decision-Making" co-auhored by Sotirios Argyrouds and Stergios Mitoulis with members of the IABSE Task Group 1.8, received the Outstanding Scientific Paper Award 2025 from the International Association for Bridge and Structural Engineering. The study introduced and applied a data-driven framework for assessing seismic resilience in interconnected infrastructure systems, integrating hazard analysis, interdependency modelling, socio-economic impacts, and structural health monitoring with emerging technologies. The paper is available here

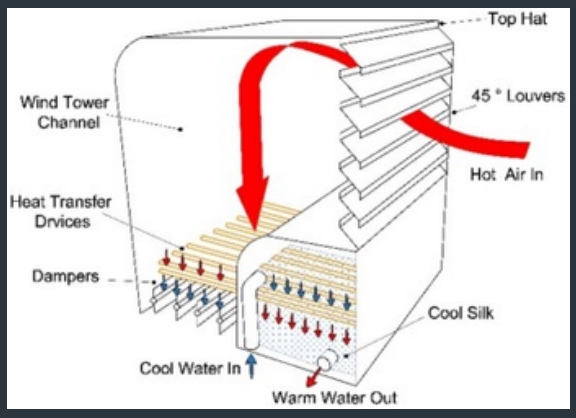
10 November, 2025: Stergios Mitoulis and Sotirios Argyroudis attended a reception hosted by the Ukraine Britain Business Council (UBBC) and Brigadier James Ellery at the Cavalry and Guards Club, and featuring inspiring remarks from Baroness Nicholson and Lord Robertson. The event highlighted shared commitments to Ukraine's reconstruction and sustainable recovery, with BridgeUkraine contributing to ongoing efforts to connect UK expertise with Ukrainian needs and European opportunities for investment, innovation, and resilience.

# **our news** Oct - Dec2025


November, 2025: Yiming Xiang joined the UCL Bartlett School of Sustainable Construction as Lecturer in Design for Construction. As a member of MetaInfrastructure.org, he continues to contribute to the ZEBAI Project, focusing on the application of machine learning and graph neural networks to enable zero-carbon, cost-effective building design. His appointment marks an important milestone in strengthening AI-driven research for sustainable construction at UCL.

7 November, 2025: A collaborative study between UCL, International Hellenic University, and Pontificia Universidad Católica de Chile introduced a new methodology for seismic assessment of bridge portfolios. The paper, "Predictive models for evaluating seismic demands for bridge portfolios" was published in Results in Engineering. By explicitly capturing record-to-record ground-motion variability through nonlinear time-history analysis and statistical modelling, the study enables efficient and transparent evaluation of large bridge inventories in highly seismic regions..




October, 2025: The review article "Energy-Saving of Passive Ventilation Systems in Thermally Modernized Residential Buildings – A Review" was published in Energy and Buildings. The study introduces an integrated framework linking building aerodynamics, climate adaptability, and hybrid passive ventilation design, bridging traditional passive systems with digital-era modelling through CFD, building energy simulation, and experimental evidence. The findings support the development of next-generation, low-carbon ventilation strategies for thermally modernised and nearly zero-energy residential buildings.

29 October, 2025: Stergios-Aristoteles Mitoulis represented Empower Ukraine and The Bartlett School of Sustainable Construction, UCL at the 4th Annual Ukrainian Infrastructure Forum in London, on the session "Opportunities for Private Sector Involvement in Major Infrastructure Projects.
He joined the panel to discuss how the private sector and academia can accelerate Ukraine's reconstruction through investment, partnerships, and skills development.

# ongoing projects

PORTAL – Adaptive strategies for enhancing threat -agnostic resilience of port ecosystems
Funding: HORIZON-MSCA-SE-2025

Empower Ukraine – Capacity building for critical infrastructure restoration in Ukraine
Funding: UK Charity-2024

FIREWISE - Proactive wildfire resilience assessment and management
Funding: UKRI/HORIZON-MSCA-PF-2024

META-GRID– Climate resilience assessment and adaptation of the European power grid
Funding: HORIZON-MSCA-PF-2024

REACT – Reusing steel for emission reduction through AI-driven cutting-stock tool
Funding: HORIZON-MSCA-PF-2024

ZEBAI - Innovative methodologies to design zero-emission and cost-effective buildings based on AI
Funding: HORIZON-CL5-2023-D4-01-01

bridgeAdapt - Sustainable adaptation of bridges deteriorated to climate and human-induced damage
Funding: British Academy-2023

AI4SURE – AI-empowered data-mining techniques for sustainable and climate-resilient infrastructure peacebuilding. Funding: British Academy-2023

WINDTUNE - Efficiency of natural ventilation toward zero-energy residential buildings
Funding: British Academy-2023

ReCharged – Climate-aware resilience for sustainable critical and interdependent infrastructure systems enhanced by emerging digital technologies. Funding: HORIZON-MSCA-SE-2021

RISKADAPT – Asset-level modelling of risks in the face of climate-induced extreme events and adaptation. Funding: HORIZON-MISS-2021-CLIMA-02

# completed projects

- DiRect - Digitally enhanced resilience of critical transport infrastructure
  Funding: HORIZON-TMA-MSCA-PF-EF-2021
- ReBounce - Integrated resilience assessment framework for bridges and transport networks exposed to hydraulic hazards
  Funding: H2020-MSCA-IF-2019
- BriFace - Novel assessment of bridge retrofitting measures through interface efficiency indices using a guided wave-based monitoring method
  Funding: H2020-MSCA-IF-2018
- TRANSRISK - Vulnerability and risk assessment of transportation systems of assets exposed to geo-hazards
  Funding: H2020-MSCA-IF-2016

## our team

**Prof Stergios Aristoteles Mitoulis, *Head***
*The Bartlett School of Sustainable Construction (BSSC), University College London (UCL) and Honorary Professor, University of Birmingham*
*PhD, DiplEng, MSc, CEng MICE, M.ASCE, M.EAEE, FHEA*
*resilience of transport assets; monitoring-driven resilience of infrastructure; damage-free; zero-maintenance bridges; Eurocode expert*

**Dr Sotirios Argyroudis, *Global Deputy Head***
*Associate Professor (Reader), Brunel University of London, PhD, DiplEng, BSc, CEng MICE, FHEA*
risk and resilience assessment of critical infrastructure and networks; multiple hazards & climate change effects

**Nadiia Kopiika, *BSSC, UCL Deputy Head***
*Research Fellow, BSSC, UCL, British Academy/CARA*
strength and reliability; strengthening; retrofitting, material properties; probabilistic approaches; non-destructive methods

**Dr Ivan Izonin, *AI/ML Lead***
*Associate Professor, British Academy/CARA*
*S.M.IEEE, M.ACM, M.INNS*
AI/ML; high-speed computational intelligence; neural-like structures; non-iterative training algorithms; ensemble models; meta learning and small data analysis

**Dr Shchasiana Arhun, *Education & Energy Efficiency Lead***
*Teaching Fellow, BSSC, UCL*
sustainable transport; energy-saving and energy-efficient technologies in transport; renewable energy integration in transport; vibration diagnostics of electric machines

**Dr Raffaele Cucuzza, *Circularity in Structures Lead***
*Postdoctoral Research Fellow (Marie-Curie), BSSC, UCL, PhD, DiplEng*
structural optimisation; data-driven design of infrastructure; LCA-driven design; eco-design; steel structures; reusing steel

**Dr Stavros Sakellariou, *GIS Lead and MetaNewsletter***
*Postdoctoral Research Fellow (Marie-Curie), Brunel University of London, PhD, MSC, DiplEng*
wildfires simulation and management; GIS & remote sensing; spatial resilience, planning and climate change

**Dr Khrystyna Myroniuk, *Building Physics Lead, Dissemination Operations***
*Associate Professor, British Academy/CARA*
heating, ventilation, and air conditioning; energy-saving buildings; EU standards; resource-saving technologies

**Dr Roberta Di Bari, *R&D and Sustainable Buildings Lead***
*Research Fellow, BSSC, UCL, PhD, MSc*
sustainable constructions; LCA; building physics

**Dr Yiming Xiang, *LLMs for Research Facilitation Lead***
*Lecturer, BSSC, UCL, PhD, MSc*
AI/design for construction, sustainable constructions; energy efficiency; LCA

**Dariia Berestok, *Operations Lead***
*Project Manager, BSSC, UCL*
project management; communication; coordination; stakeholder engagement; process optimisation

**John Adah Agbo, *Event Organisation Lead***
*Doctoral researcher, quantity surveyor, BTech, MSc*
climate-resilience and sustainability; optimisation; transport infrastructure; adaptation

**Mohammed Almousa, *Communications Manager & Website Lead***
*Doctoral researcher, architecture & building science, BSc, MSc*
integration of micro-mobility with the public transportation

**Francesco Pentassuglia**
*Doctoral researcher, structural engineer, MEng, MSc*
FEM; risk assessment and safety; low-carbon; energy efficiency; structural engineering; remote control

**Seyyed Mohammad Hosseini, *Content & Communications Assistant***
*Doctoral researcher (Brunel University of London), MSc, BSc in Civil Engineering,* infrastructure resilience; NbS, Finite Element Modelling, Building Information Modelling (BIM)

**Beghal Rasool**
*Doctoral researcher, UCL,* MEng, GMICE
bridge engineer

**Kalliopi Moysiadi,**
*Doctoral researcher, UCL,* MEng MSc CEng MICE
temporary works, design management, major Infrastructure delivery

**Dr Jinsheng Wang**
*Researcher, PhD, MSc, BEng*
structural reliability; uncertainty quantification; machine learning; bridge engineering

**Henrry V Rojas Asuero**
*Doctoral researcher (Pontificia Universidad Católica de Chile), MSc in Civil Engineering*
vulnerability and fragility assessment; civil engineering systems analysis

**Dr Marianna Loli**
*principal researcher (Marie-Curie), PhD, DiplEng,* MSc, project coordinator Grid Advisors, Associate at Innovation Center on Natural Hazards & Infrastructure (ICONHIC); seismic risk assessment; geotechnical design; numerical and experimental modelling (associated member)

**Prof Nataliya Shakhovska**
*Rector, Lviv Polytechnic National University*
AI; big data; database and data warehouse integration; distributed systems; integrated systems and dataspaces; VR/AR (associated member)

**María Montiel Durá Aras, *Urban Development Specialist***
*Doctoral researcher, DegreeEng, MBA*
civil construction and urban transports and services; urban development of cities (associated member)

**Dr Eleonora Perugini**
*Senior Researcher, PhD, MSc, CEng*
remote sensing; bridge-scour; risk assessment; field monitoring; numerical modelling; floods; nearshore morphodynamics; estuarine and river environment (associated member)

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For more information about our team and research project portfolio visit:
https://metainfrastructure.org