2BeSafe

FINAL CONFERENCE OF THE

2BESAFE PROJECT

15–16 JANUARY 2026

FACULTY OF CIVIL ENGINEERING,
UNIVERSITY OF ZAGREB

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Croatian Science Foundation

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University of Zagreb
Faculty of Civil Engineering

NEW VULNERABILITY MODELS OF TYPICAL BUILDINGS IN URBAN AREAS: Applications to seismic risk assessment and target retrofitting methodology

University of Zagreb
Faculty of Civil Engineering
Fra Andrije Kačića Miošića 26, Zagreb, Croatia

Croatian Science Foundation Installation Research Project

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Title
NEW VULNERABILITY MODELS OF TYPICAL BUILDINGS IN URBAN AREAS:
Applications to seismic risk assessment and target retrofitting methodology
2BESAFE Final conference
15–16 January 2026 · Zagreb

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Contents

"Without proper calculations, every project becomes a surprise".

Preface

Dear friends and colleagues,

We are pleased to welcome you to the final conference of the 2BESAFE project – NEW VULNERABILITY MODELS OF TYPICAL BUILDINGS IN URBAN AREAS: Applications to seismic risk assessment and target retrofitting methodology. The 2BESAFE research project was funded by the Croatian Science Foundation at the University of Zagreb Faculty of Civil Engineering. During its implementation, the research team achieved significant results in developing a methodology for assessing the seismic vulnerability of existing buildings in urban areas, combining experimental and numerical research, field observations, and innovative approaches to damage assessment. Based on extensive analyses, methods for targeted retrofitting of critical typical buildings were proposed, achieving an optimal level of safety while ensuring cost-effectiveness and allowing continuous use of the building during retrofitting.

"Preparations are like life jackets — the day you need one isn't the day you want to find out you forgot it."

The project results have been continuously presented through scientific papers and at numerous international conferences which has significantly contributed to the project's visibility at both national and European levels. During these years, many annual

Members of the 2BESAFE project

Mario **Uroš**

Marta **Šavor Novak**

Marija **Demšić**

Janko **Koščak**

workshops were organised with the participation of eminent scientists. These workshops greatly contributed to the dissemination of knowledge not only within the 2BESAFE research group but also in the wider scientific and professional community.

We especially highlight the contribution of the project team members in post-earthquake activities in Zagreb and Petrinja, where, in cooperation with institutions, experts, and volunteers, they participated in rapid visual inspections of buildings, collection of damage data, development of databases, educational activities, and preparation of guidelines for the reconstruction of damaged buildings. These activities further emphasised the importance of the research conducted within the project and enabled its direct application in real situations.

We would also like to acknowledge those who have continuously supported our work, including the Croatian Science Foundation, the University of Zagreb Faculty of Civil Engineering, Croatian Centre for Earthquake Engineering, and the Croatian Chamber of Civil Engineers.

"While the lazy are still thinking, the hard-working have already acted."

2BESAFE Team

Senad **Medić**

Snježan **Prevolnik**

Ante **Pilipović**

Romano **Jevtić Rundek**

Maja **Baniček**

2BESAFE - Conference
15 January, Zagreb

8:30	**Registration**	
8:45	**Lecture**	**Mario Uroš** University of Zagreb Faculty of Civil Engineering, Croatia **New vulnerability models of typical buildings in urban areas: applications to seismic risk assessment and target retrofitting methodology - 2BESAFE**
9:15	**Keynote**	**Sergio Lagomarsino** Department of Civil, Chemical and Environmental Engineering, University of Genoa, Italy **Seismic assessment of existing masonry buildings: modelling, analysis and verification issues**
10:00	**Lecture**	**Ante Pilipović** University of Zagreb Faculty of Civil Engineering, Croatia **Reduction of seismic risk through target retrofitting**
10:20	**Lecture**	**Andrea Brunelli** Department of Civil, Chemical and Environmental Engineering, University of Genoa, Italy **Potential of time history analysis in masonry building assessment and retrofitting strategy**
10:40 - 11:00	**COFFEE BREAK**	
11:00	**Keynote**	**Paolo Bazzurro** University School for Advanced Studies IUSS Pavia, Italy **The role of risk assessment in shaping real-world mitigation decisions**
11:45	**Lecture**	**Alejandro Calderón** Global Earthquake Model (GEM) Foundation, Italy **Seismic risk in Croatia: assessing hazard, exposure and vulnerability in european perspective**
12:05	**Lecture**	**Marta Šavor Novak** University of Zagreb Faculty of Civil Engineering, Croatia **Earthquake risk assessment of the city of Zagreb**

"Solid foundation,
peaceful sleep."

12:25 - 13:30	**LUNCH BREAK**	
13:30	**Keynote**	**Igor Gjorgjiev** Institute of Earthquake Engineering and Engineering Seismology (IZIIS), Ss. Cyril and Methodius University in Skopje, North Macedonia **Enhancing earthquake resilience through prevention**
14:15	**Lecture**	**Tomislav Tomašić** Isonoe d.o.o., Croatia **GaiaPulse: IoT solutions for structural health monitoring**
14:35	**Lecture**	**Marijan Herak** University of Zagreb Faculty of Science, Department of Geophysics, Croatia **From ground motion to damage: bringing macroseismic intensity back to hazard arena**
14:55 - 15:10	**COFFEE BREAK**	
15:10	**Lecture**	**Nina Serdar** University of Montenegro, Faculty of Civil Engineering, Montenegro **New national seismic risk model for Montenegro**
15:30	**Lecture**	**Maja Baniček** University of Zagreb Faculty of Civil Engineering, Croatia **Joint project of the University of Zagreb Faculty of Civil Engineering and EPFL: developing retrofit strategies for historical masonry building aggregates in Zagreb**
15:50	**Lecture**	**Mislav Stepinac** University of Zagreb Faculty of Civil Engineering, Croatia **Advanced resilience techniques for historical and understudied sacral architecture**
16:10	**Lecture**	**Juraj Pojatina** Studio Arhing d.o.o., Croatia **Conceptual design strategies for graded seismic strengthening of buildings**

2BESAFE - Conference
16 January, Zagreb

8:30	**Keynote**	**Svetlana Brzev** Department of Civil Engineering, University of British Columbia, Canada **Seismic behaviour of existing precast reinforced concrete large panel buildings**
9:15	**Lecture**	**Romano Jevtić Rundek** University of Zagreb Faculty of Civil Engineering, Croatia **The case study of JU-61z, a precast RC large panel building**
9:35	**Lecture**	**Senad Medić** University of Sarajevo Faculty of Civil Engineering, Bosnia and Herzegovina **Seismic assessment of a high-rise residential building from the 60s**
9:55	**Lecture**	**Jelena Pejović** University of Montenegro, Faculty of Civil Engineering **Seismic performance assessment of RC high-rise buildings in the southern Euro-Mediterranean region**
10:15 - 10:35		**COFFEE BREAK**
10:35	**Keynote**	**Vitor Silva** University of Aveiro/Global Earthquake Model, Portugal **Built, broken, better: seismic vulnerability modelling across a building's life**
11:20	**Lecture**	**Helen Crowley** Global Earthquake Model (GEM) Foundation, Italy **From global to local: how collaboration with GEM will support seismic risk modelling in Croatia**
11:40	**Lecture**	**Pablo Alfonso García de Quevedo Iñarritu** University School for Advanced Studies IUSS Pavia, Italy **Effects of seismic sequences and damage accumulation on risk analysis**
12:00	**Lecture**	**Iva Dasović** University of Zagreb Faculty of Science, Department of Geophysics, Croatia **Preparations for the new seismic hazard maps for Croatia**
12:20 - 13:30		**LUNCH BREAK**

"Fix it before it breaks, or pay for it later—and we all know fixing is never fun!"

13:30	**Keynote**	**Marina Rakočević** Faculty of Civil Engineering, University of Montenegro, Montenegro **Montenegrin earthquake from 1979 - lessons and experiences**
14:00	**Lecture**	**Mihaela Skurić** Institute for the Restoration of Dubrovnik, Croatia **Dubrovnik - restoring a living city**
14:20	**Lecture**	**Krešimir Todorić** Toding d.o.o., Croatia **Seismic isolation of an existing reinforced concrete frame building in Croatia: post-earthquake rehabilitation feasibility, cost evaluation, and comparison with conventional retrofit**
14:40	**Lecture**	**Hrvoje Čagalj** Ekonerg Ltd, Croatia **Experimental-based calibration of nonlinear models for reinforced concrete shear walls with different failure mechanisms**
15:00 - 15:20		**COFFEE BREAK**
15:20		**Josip Atalić** University of Zagreb Faculty of Civil Engineering, Croatia **What the … is CCEE?**
15:50		**Matjaž Dolšek** University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia **Five years of seismic stress tests of the building stock in Slovenia**
16:20		**Neja Fazarinc** University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia **Simulation of sustainable renovation of building stock in seismic areas**
16:40		**Branko Kordić** Croatian Geological Survey, Croatia **EPOS Croatia**

Meet the lecturers

"The bill always comes when you least expect it."

"Preventing problems is like eating vegetables – nobody enjoys it, but you'll thank yourself later."

New vulnerability models of typical buildings in urban areas: applications to seismic risk assessment and target retrofitting methodology - 2BESAFE

Name and Surname:
Mario Uroš

Affiliation:
University of Zagreb Faculty of Civil Engineering, Department of Engineering Mechanics, Croatia

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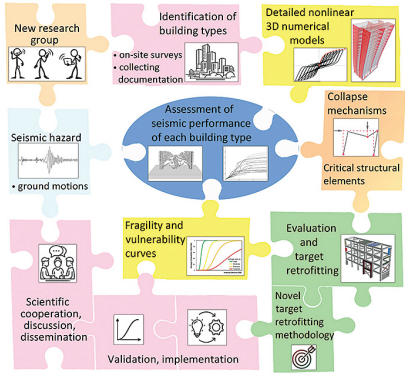
uros@grad.hr

Personal motto
To understand a person, walk a mile in their shoes.

Biography:
Mario Uroš is a Associate Professor at the Department of Engineering Mechanics at Faculty of Civil Engineering, University of Zagreb. He worked on the Disaster Risk Assessment for the Republic of Croatia - earthquake risk assessment. He is the head of the Zagreb branch at the Croatian Center for Earthquake Engineering – Intervention Service. He is member of the Croatian Chamber of Civil Engineers (CCCE) and he is a member of the expert group for the adoption of technical regulations for building structures and of expert commissions at the Ministry of Construction and the Ministry of Culture and Media. Also, he is a member of the subcommittee HZN/TO 548/PO 8, Construction Eurocodes; Eurocode 8, Design of seismic resistance of structures in the Croatian Standards Institute. He has been one of the coordinators of rapid damage assessments of buildings by civil engineers after the earthquakes in Zagreb in March 2020 and Petrinja in December 2020. He has won several awards, including the Medal of the City of Zagreb, the award of the CCCE "Kolos" in 2020 and Order of Croatian Interlace from the President of the Republic of Croatia for his contribution to post-earthquake activities.

"Smooth seas do not make skillful sailors.



Abstract:

Seismic risk is a key priority in South-Eastern Europe, but activities of the community to its reduction are very limited. Recent seismic events in the region have highlighted the potentially devastating impacts of earthquakes. The 2BESAFE project is focused on a retrofitting of most vulnerable building types which represent a significant part of the urban building stock in the region. First, the seismic hazard on the location is defined and database of ground motions are formed. Complex collapse mechanisms of the selected structures are systematically described and new fragility and vulnerability models are developed. Finally, a new methodology for target retrofitting concept (TRC) of the most vulnerable building types is develop. The TRC is very important in the retrofitting of vulnerable buildings on a larger scale. High costs, long-term relocation of occupants, and strict compliance with safety standards significantly hinder reconstruction efforts. The TRC approach provides an optimal, practical, and cost-efficient reconstruction solution that ensures adequate safety for the site-specific hazard.

Favorites:

3

Favorite paper:

Post-earthquake damage assessment of buildings – procedure for conducting building inspections

https://doi.org/10.14256/JCE.2969.2020

Seismic assessment of existing masonry buildings: modelling, analysis and verification issues

Personal motto
Peace begins
with a smile.

Name and Surname:
Sergio Lagomarsino

Affiliation:
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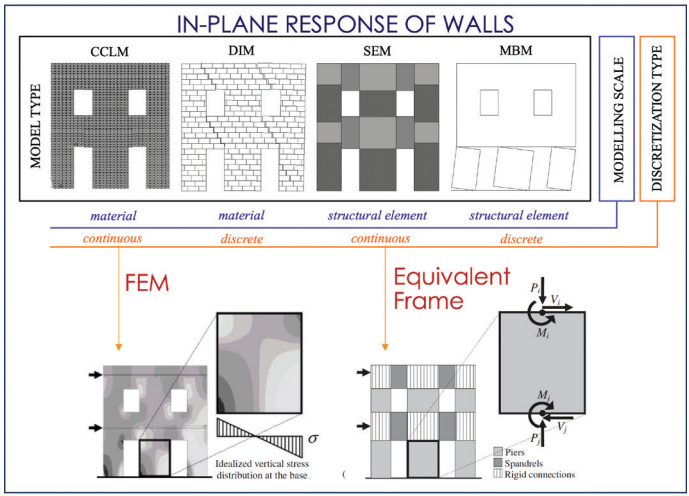
Biography:
Sergio Lagomarsino is professor of Structural Engineering at the University of Genoa. His main research topics are: seismic assessment of existing structures, nonlinear modelling of masonry buildings, preservation of cultural heritage and historical centres, seismic risk and vulnerability analysis. He has coordinated the European project PERPETUATE on the seismic assessment and protection of cultural heritage assets. At present, he is coordinating the project MARS (Seismic damage and risk maps of the Italian building stock), funded by the Civil Protection Agency and ReLUIS Consortium. He served in the panels for the revision of Eurocode 8, Part 3: "Assessment and retrofitting of buildings", and for the drafting of the "Italian Guidelines for the assessment and preservation of cultural heritage in seismic areas". He developed the software program TREMURI, for the nonlinear seismic analysis of masonry buildings, and the Italian survey form for post-earthquake damage assessment of churches.

"There's a difference between saying and doing.



Abstract:

The lecture is aimed to explain the basis and critical issues of equivalent-frame modelling approach for the seismic assessment of existing masonry buildings, also considering mixed masonry-R.C. configurations, with in-depth discussion on the role of connections (flange effect) and on the influence of out-of-plane behaviour (façades with few internal shear walls). Distinctive features related to the use of pushover analysis are considered: force distribution, flexible floors, and the need to integrate global displacement verification with local checks. Finally, the potentials of non-linear dynamic analysis, as an alternative to non-linear static (pushover) analysis, are discussed.

Favorite:

2

Reduction of seismic risk through target retrofitting

Personal motto
Semper magis.

Name and Surname:
Ante Pilipović

Affiliation:
University of Zagreb Faculty of Civil Engineering, Department of Engineering Mechanics, Croatia

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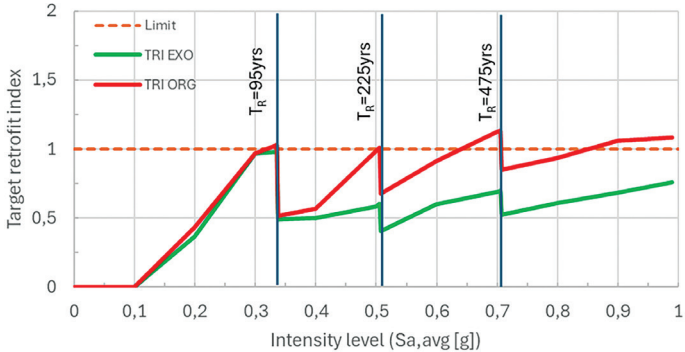
Biography:
Ante likes to think of himself as a pracademic, combining academic research and field work, both related to earthquake engineering. In research, he is investigating the impact of retrofit interventions on seismic risk reduction on an urban scale, but he also likes to explore intensity measures and ground motion record selection topics on the side. In the field, he uses his technical know-how to help urban search and rescue teams enter demolished buildings safely and return home. This usually means that he goes in first.
Therefore, he works in disaster management. During regular working hours, in the preparedness phase with seismic risk, and when a catastrophic event happens, in the first responder phase. This seems to work well for now.
Also, he is about to finish his PhD thanks to the 2BE-SAFE project, which opened many opportunities for him to work with wonderful people in the world of earthquake engineering and risk.

> All we have to decide is what to do with the time that is given us.



Abstract:

The concept of target retrofitting was a major topic throughout the 2BESAFE project, which aimed to assess the effectiveness of such interventions in seismic risk assessment applications. Target retrofit solutions are local interventions that strengthen only critical elements of a building to prevent or postpone its main failure mechanism. They are designed for maximum impact at minimal initial cost of intervention. When applied to a portfolio of similar vulnerable buildings, such as some types of URM buildings in Zagreb, they can reduce seismic risk substantially. This investigation presents the main results of the 2BESAFE project regarding URM buildings, the newly developed vulnerability models and the impact of target retrofit solutions on the improvement of their seismic performance, as well as on reduction in seismic risk.

Favorites:

24

Favorite paper:

Types of collapse mechanisms in Hatay province after the 2023 Turkey-Syria earthquake

Potential of time history analysis in masonry building assessment and retrofitting strategy

Personal motto
If I want to be overly ambitious: "Good enough is not enough".

In Italian, you say "Domandare è lecito, rispondere è cortesia.", which in English becomes "Asking is allowed; answering is a courtesy."

Name and Surname:
Andrea Brunelli

Affiliation:
Dept. of Civil, Chemical and Environmental Engineering, University of Genoa, Italy

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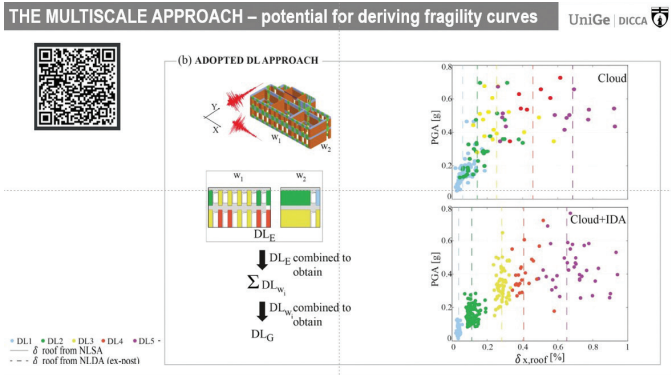
Biography:
Since December 2022, Andrea has been a Postdoctoral Researcher at the University of Genoa, after completing his PhD—also in Genoa—on the topic of soil–structure interaction for masonry buildings. His work mainly focuses on the assessment of the seismic safety of existing and new masonry structures. He is involved in several ReLUIS projects that primarily address the modelling and seismic vulnerability of buildings in aggregate, mixed (reinforced concrete–masonry) buildings, the modelling of structural retrofitting interventions, and the application and evaluation of current Italian and European codes.
Since November 2024, he has been a consultant for S.T.A. DATA srl, where he coordinates and manages the technical–scientific activities related to the development of the 3Muri software.
He is the author of 23 scientific publications, including 9 papers in international journals, 1 book chapter, and the remaining works published in conference proceedings.



Abstract:

The lesson aims to show how to define the damage level of a masonry building solely through time history (nonlinear dynamic) analyses, without using drift values obtained from static analyses or fixed for typology of building. The presented method defines the global damage level of building based on the distribution of damage in the masonry wall elements.

Traditional code verification using static and dynamic analyses with seven accelerograms, as required by NTC2018, will also be compared, using the new tool in the 3muri software, which now allows practitioners to employ methods that until now have been more oriented toward scientific research. This approach is also applied to the simulation of several retrofitting interventions.

Favorites:

3

Favorite paper:

Numerical simulation of the seismic response and soil-structure interaction for a monitored masonry school building damaged by the 2016 central Italy earthquake

doi.org/10.1007/s10518-020-00980-3

The role of risk assessment in shaping real-world mitigation decisions

Personal motto
Always give it your best.

Name and Surname:
Paolo Bazzurro

Affiliation:
University School for Advanced Studies IUSS Pavia, Italy

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Biography:
Paolo Bazzurro is a Professor of Engineering at IUSS Pavia, Italy. He holds an M.S., Engineer Degree, and Ph.D. in Civil Engineering from Stanford University. Before joining IUSS in 2012, he spent more than 25 years working in Europe and the United States, focusing on the risk assessment of financial losses from natural disasters for corporate clients, insurance companies, brokers, governments, and international institutions, including the World Bank, the Asian Development Bank, and the Inter-American Development Bank. He has served as Deputy Chair of the GEM Scientific Board and as a member of the Italian National Great Risks Committee, appointed by the Office of the Prime Minister. He is also part of the international expert panel selected by the Italian National Institute of Geophysics and Volcanology to review the development of the new Italian Seismic Hazard Maps. He has authored more than 200 peer-reviewed publications in earthquake engineering and related fields.

> Treat others the way you would like to be treated.

Abstract:

Structural engineering is essential not only for designing safe structures. When paired with strong mathematical skills and probability and statistics, it opens doors to unexpected applications, where engineering work can make a meaningful impact. This presentation introduces catastrophe risk assessment, which evaluates the likelihood and severity of losses from natural hazards like earthquakes and tropical cyclones, followed by real-world applications in which risk assessment is key in developing effective mitigation strategies. This field is not reserved for data scientists, engineers play a key role too. It underpins how insurance companies set fair premiums, how banks decide to whom and at what rate they should lend money, and how governments plan to reduce the impacts of disasters. Risk assessment supports stakeholders in making informed, proactive decisions. It is a high-impact work that offers a rewarding career while improving community resilience.

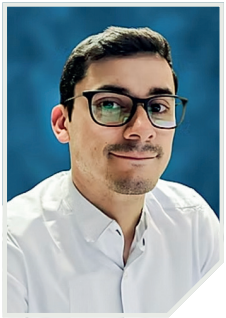
Favorites:

4

Favorite paper:

Site dependence and record selection schemes for building fragility and regional loss assessment
https://doi.org/10.1002/eqe.2873

Seismic risk in Croatia: assessing hazard, exposure and vulnerability in european perspective



Personal motto
Work hard,
rest harder.

Name and Surname:
Alejandro Calderón

Affiliation:
Global Earthquake Model Foundation, Italy

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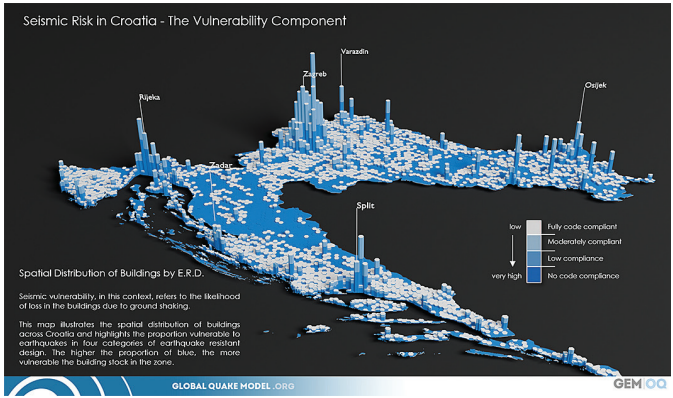
Biography:
Alejandro is a structural engineer from Costa Rica with a decade of specialization in seismic risk research. His career began with the inspection of civilian and industrial facilities in his home country, which led him to pursue advanced studies in Earthquake Engineering and Seismology from the University of Pavia, in Italy.
For the past ten years, his primary focus has been on advancing the GEM Foundation's Global Risk Model, leading the development of seismic risk assessment models for numerous countries across Latin America, South Asia, and the Middle East.
He finds the greatest professional fulfillment in two areas: collaborating closely with dedicated local scientists and professionals to build tools that make communities safer, and finding innovative strategies to communicate risk results effectively to stakeholders and decision-makers.

> In theory, theory and practice are the same. In practice, they are not.



Abstract:

The Global Earthquake Model (GEM) Foundation's Global Risk Model contains seismic risk assessments for over 200 organized territories worldwide. This study presents an analysis of its seismic hazard, exposure, and vulnerability components across Europe, with a specific focus on Croatia. We detail the model's components for the Balkan nation, evaluate its regional seismic risk, and provide a comparative analysis with other high-risk European countries, like Italy, Greece, and Romania. Following the identification of the principal drivers of risk, we illustrate through a straightforward case study how the baseline risk can be mitigated via strategic interventions such as seismic retrofitting.

Favorites:

1988

Favorite paper:

A national seismic risk model for El Salvador: development, implementation, and novel applications in disaster management

https://doi.org/10.1016/j.ijdrr.2025.105861

Earthquake risk assessment of the city of Zagreb

Name and Surname:
Marta Šavor Novak

Affiliation:
University of Zagreb Faculty of Civil Engineering, Department of Engineering Mechanics, Croatia

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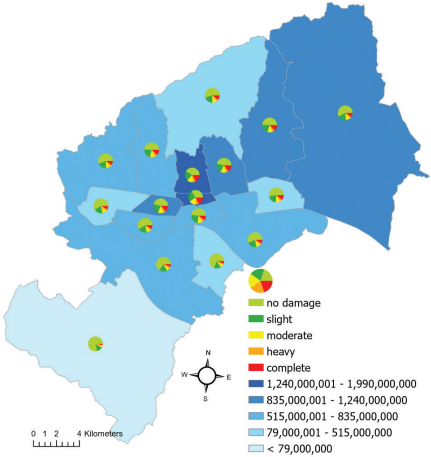
msavor@grad.hr

Personal motto
Where there is a will, there is a way.

Biography:
Marta Šavor Novak is an associate professor and head of the Chair for Statics, Dynamics and Stability of Structures in the Department of Engineering Mechanics at the University of Zagreb Faculty of Civil Engineering (FCE). She is engaged in teaching at undergraduate, graduate, advanced master and doctoral levels at the FCE. She is part of the team which actively participates in numerous activities related to the earthquake risk reduction at the international, national and local levels. Following the earthquakes in Croatia in 2020, she took part in organizing and conducting rapid building damage assessments with civil engineers, as well as supporting various state-led relief activities, for which she received several awards. She has participated in various national and international projects and workshops related to earthquake risk assessment. She has published papers in international peer-reviewed journals and serves as a reviewer for high-impact scientific publications.

“What goes around, comes around.



Abstract:

This lecture presents the Earthquake Risk Assessment of the City of Zagreb, initiated as a pilot study for national earthquake risk assessments in Croatia. Prompted by the 2020 earthquakes, the project represents a significant advancement over earlier national assessments which focused on a critical Zagreb scenario. The main activities of the project are briefly described, focusing on its most critical component: the collection of building data required to develop a GIS building inventory database. The main risk metrics, based on the risk assessment carried out in OpenQuake using building-by-building data, are presented. It was shown that earthquake risk in Zagreb is high, as unfortunately confirmed by the 2020 events. The newly developed risk model can serve as a solid foundation for future risk mitigation efforts in the city, which the 2020 earthquakes have shown to be urgently required across Croatia.

Favorites:

5

Favorite paper:

Seismic risk reduction in Croatia: mitigating the challenges and grasping the opportunities
https://doi.org/10.5592/CO/FTCE.2019.04

Enhancing earthquake resilience through prevention

Personal motto
Life is a marathon, keep running.

Name and Surname:
Igor Gjorgjiev

Affiliation:
Institute of Earthquake Engineering and Engineering Seismology (IZIIS), Ss. Cyril and Methodius University in Skopje, North Macedonia

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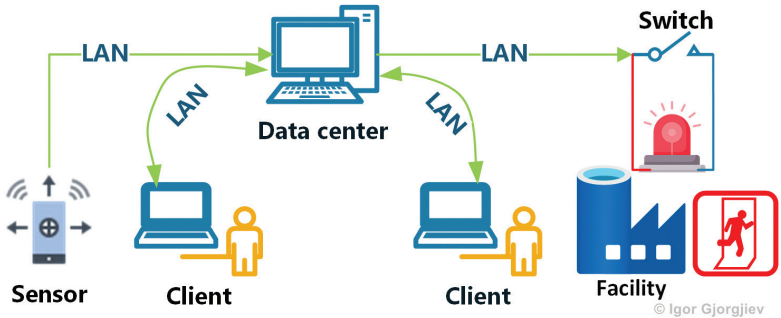
Biography:
Igor Gjorgjiev is a Full Professor at the Institute of Earthquake Engineering and Engineering Seismology (IZIIS) in North Macedonia. With over 25 years of academic and research experience, his work focuses on earthquake engineering, performance-based and sustainable design, base isolated structures, structural health monitoring, and the development of climate and disaster resilient infrastructure systems. He has participated in numerous international projects funded by NATO, Horizon Europe, DG ECHO, the World Bank, and the European Commission, contributing to the advancement of knowledge in seismic protection and disaster resilience. His scientific work encompasses nonlinear analysis, base isolation technologies, and the application of digital solutions for structural health monitoring and early warning systems. He is the author and co-author of more than 70 scientific publications and a recipient of the MASE Award for Outstanding Achievements in Structural Engineering. His current research integrates engineering innovation with digital technologies to promote safer, more sustainable, and resilient communities.

> Take care of your health, your body is the only place you have to live.



Abstract:
Dozens of earthquakes occur around the world every day, and even though most are harmless, moderate events can still trigger crowd panic or cause injuries. The application of prevention and preparedness measures before a disaster plays a central role in disaster risk reduction, helping society minimize potential losses. These measures require an effective combination of educational, technological, and institutional actions aimed at reducing risk prior to an earthquake event. Within this framework, we implemented STEAM-based educational initiatives for students, while in parallel continuously promoting earthquake awareness among pupils to foster a culture of preparedness from an early age. On the technological side, applied preparedness measures such as alerting systems, structural health monitoring and the development of platforms for needs assessment have significantly strengthened institutional capacities and raised awareness. This presentation will discuss the development and implementation of these measures in Macedonia, demonstrating how they collectively create a prevention-focused framework that enhances earthquake readiness across all levels of society.

GaiaPulse: IoT solutions for structural health monitoring

Personal motto
Put in the effort now for an easier tomorrow.

Name and Surname:
Tomislav Tomašić

Affiliation:
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Email:
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Biography:
Tomislav Tomašić holds a Master's in Mechatronics. He started his career at INETEC developing control systems, while co-founding Visiobike, an electric bike startup. From 2017 to 2020, he worked at Rimac Automobili on autonomous vehicle algorithms and battery management systems. In 2020, he founded Isonoe, an R&D company in Zagreb that has been slowly evolving from consulting to developing proprietary products, including GaiaPulse, created in collaboration with the University of Zagreb Faculty of Civil Engineering.

Fortune favors the prepared mind.

Abstract:

GaiaPulse is a structural health monitoring ecosystem developed by Isonoe d.o.o. in collaboration with the Faculty of Civil Engineering, University of Zagreb. The system addresses the critical need for continuous monitoring of building integrity, particularly relevant for seismic risk assessment in urban areas. The product line includes battery-powered devices for seismic event recording, long-term spectral monitoring, and crack width monitoring. With multi-year battery life, the system enables long-term baseline monitoring, making before-and-after comparison possible following earthquakes, fires, or other damaging events. All devices feed data into a cloud platform for visualization and alerting. The presentation covers the development process, interdisciplinary collaboration, and future directions including ambient vibration monitoring.

Favorites:

9

Favorite paper:

Self-Balancing Mobile Robot Tilter
https://hrcak.srce.hr/file/132177

From ground motion to damage: bringing macroseismic intensity back to hazard arena

Personal motto
Quality over quantity.

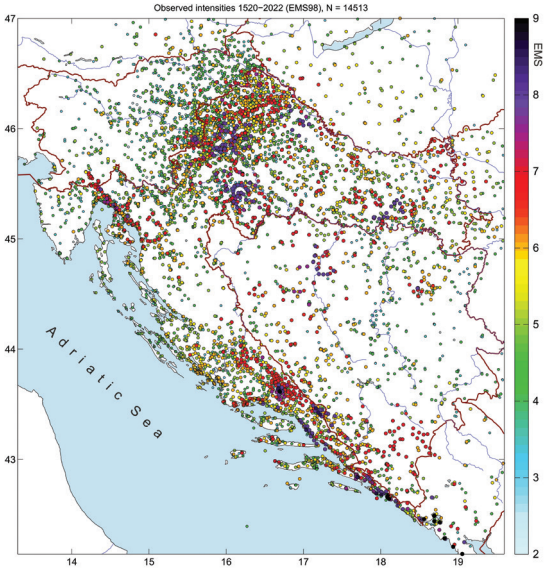
‘A’ players hire ‘A’ players. ‘B’ players hire ‘C’ players.

Name and Surname:
Marijan Herak

Affiliation:
Faculty of Science, Department of Geophysics
University of Zagreb, Croatia

Email:
mherak@gfz.hr

Biography:
Marijan Herak is a Croatian seismologist and professor emeritus at the Department of Geophysics, Faculty of Science, University of Zagreb. He pursued training in Germany, Italy, the USA, and China. His research is mostly related to studies of the seismicity of Croatia, properties of the Earth’s interior, surface waves, earthquake quantification, historical seismology, and seismic hazard assessment. He has published 92 papers in journals indexed in the Web of Science and several dozen other papers and studies. His works have been cited around 2,000 times, with an h-index of 24 (WoS) and 31 (Scholar). He is also the author of computer programs for various seismological analyses and the principal author of the Croatian seismic hazard map. He has participated in more than 20 international and domestic research projects. In 2016, he was awarded the ‘Andrija Mohorovičić’ Prize by the University of Zagreb, and in 2024 he was elected a full member of the Croatian Academy of Sciences and Arts.



Favorites:

412

Abstract:

Croatia used macroseismic-intensity (MI)–based seismic hazard maps until the current peak-ground-acceleration (PGA) map was introduced 15 years ago. This shift moved the focus from expected earthquake effects to expected ground-motion properties—from consequence to cause. While the change was logical for engineering and building design as it removed the physically unsound MI–PGA conversion, it deprived risk assessors, urban planners, and spatial-development professionals of crucial information on expected damage to the built environment. As a result, unreliable PGA–MI conversions are still used, and many official documents continue to rely on MI-based formulations and obsolete hazard maps. In this lecture, I will outline the key requirements, differences, strengths, and limitations of both approaches and argue that future hazard assessments in Croatia should include both MI and spectral acceleration maps.

Favorite paper:

ModelHVSR - A Matlab Tool to Model Horizontal-to-Vertical Spectral Ratio of Ambient Noise.

https://doi.org/10.1016/j.cageo.2007.07.009

New national seismic risk model for Montenegro

Personal motto
No use crying over spilled milk.

> Everyone is born to die once. Honor and shame live forever.
>
> Petar II Petrović Njegoš

Name and Surname:
Nina Serdar

Affiliation:
University of Montenegro, Faculty of Civil Engineering, Montenegro

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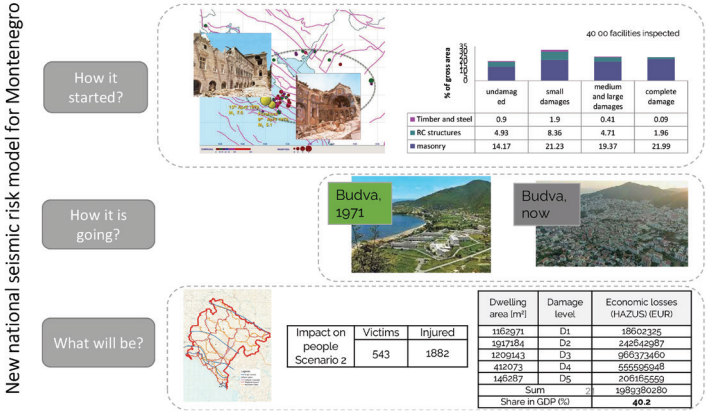
ninas@ucg.ac.me

Biography:
Nina was born in Kotor, Montenegro, in 1981 and earned her BSc in Civil Engineering from the University of Montenegro in 2006. She completed her PhD in 2018 on the seismic analysis of curved RC bridges. Since 2022, she has been an Assistant Professor at the Faculty of Civil Engineering, focusing on masonry and concrete structures. Her research centers on seismic performance, structural resilience, and disaster risk assessment, with particular interest in improving national methodologies for risk evaluation. She has contributed to major national studies in the field of disaster risk management and authored numerous scientific papers in journals and international conferences. Her academic and professional work aims to strengthen evidence-based approaches to seismic safety in Montenegro and the wider region.



Abstract:

This presentation introduces Montenegro's new national seismic risk assessment, developed using updated hazard scenarios and analyses of potential impacts on buildings, people and the economy. Two representative earthquake scenarios were examined to illustrate how different levels of shaking may affect communities across the country. The results show that both likely and severe events could produce substantial consequences, particularly in coastal and densely populated areas. In the final part, the presentation also discusses how the exposure model could be improved in the future, especially in regions where current data do not fully reflect local building characteristics. The aim is to explain seismic risk in a clear and accessible way and highlight why better exposure information is essential for effective planning and preparedness.

Favorite paper:

The one that I have not published yet.

Favorites:

9

Joint project of the University of Zagreb Faculty of Civil Engineering and EPFL: developing retrofit strategies for historical masonry building aggregates in Zagreb

Name and Surname:
Maja Baniček

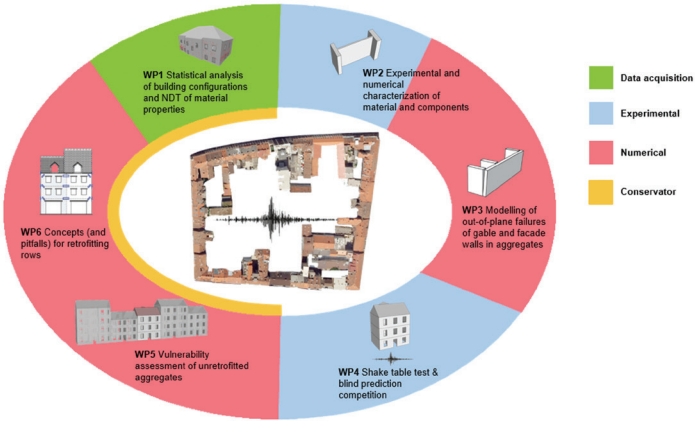
Affiliation:
University of Zagreb Faculty of Civil Engineering, Croatian Centre for Earthquake engineering, Croatia

Email:
maja.banicek@grad.unizg.hr

Personal motto
Be curious. Be creative. Let your mind expand.

Biography:
Maja Baniček is a Postdoctoral Researcher at the Croatian Centre for Earthquake Engineering, Faculty of Civil Engineering, University of Zagreb. She actively contributes to the development of advanced numerical methods for analysing existing unreinforced masonry (URM) structures, with a focus on nonlinear analysis, finite element methods, and non-smooth contact dynamics for capturing the interaction between in-plane and out-of-plane behaviour. Her research interests include the seismic response of historical urban fabric and methodologies for vulnerability and risk assessment. She served as one of the coordinators of post-earthquake evaluation efforts following the 2020 Zagreb and Petrinja earthquakes, for which she received the Kolos award of the Croatian Chamber of Civil Engineers. She is actively involved in seismic risk assessment projects and is the author of several publications in earthquake engineering and numerical modelling.

“Think outside the box.



Abstract:

The project focuses on developing seismic retrofit strategies for historical masonry building aggregates in Zagreb, where the 2020 earthquakes highlighted the seismic vulnerabilities of these structures. These aggregates, built mainly at the end of the 18th and beginning of the 20th century, exhibit weaknesses due to flexible timber floors, limited transverse walls, poor wall connections, and strong interaction between adjacent buildings. Since their seismic response cannot be understood by analyzing single units, the project aims to model entire aggregates and propose minimally invasive, reversible, and heritage-compatible strengthening measures. Through field surveys, non-destructive testing, laboratory experiments, numerical modeling, and a large-scale shake-table test, the project will generate new data, improve assessment tools, support updates to Eurocode procedures, and enhance knowledge transfer to the engineering community.

Favorite paper:

Line geometry and 3D graphic statics
https://doi.org/10.14256/JCE.2725.2019

Favorites:

13

Advanced resilience techniques for historical and understudied sacral architecture

Personal motto
As King Arthur drew Excalibur from the stone, in heritage research our quest is to draw knowledge from historical stone and brick masonry to strengthen and safeguard our built legacy.

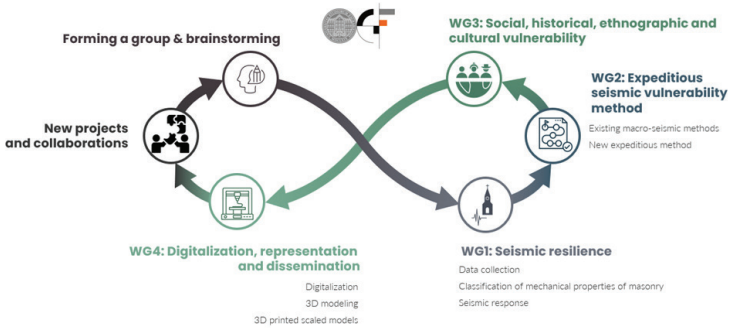
Name and Surname:
Mislav Stepinac

Affiliation:
University of Zagreb Faculty of Civil Engineering, Department for Structures, Croatia

Email:
mstepinac@grad.hr

Biography:
Mislav Stepinac, Assistant Professor and Head of the University of Zagreb Faculty of Civil Engineering, Department for Structures, University of Zagreb, is specialising in earthquake engineering, masonry and timber structures, digital diagnostics and rehabilitation of existing buildings. He has led national and international research projects on seismic assessment, NDT, energy upgrading and damage detection, including the ARES project and the national training centre for nearly Zero Energy Buildings. His research stays in Portugal, Slovenia, Sweden, France, Germany, Greece and Canada expanded collaborative networks. He received several awards for scientific excellence and highly cited papers. He authored more than forty journal papers, numerous conference contributions, two handbooks and several book chapters. His teaching includes earthquake engineering, precast concrete structures, conceptual design and courses in masonry and concrete. He is active in COST Actions, ICOMOS, ISCARSAH and Croatian and European standardisation committees for Eurocodes. He reviews for major journals and contributes to scientific boards of international conferences. He is vice-president of ICOMOS Croatia.

> In theory, there is no difference between theory and practice. In practice, there is.



Abstract:

The presentation is presenting advances knowledge on the resilience of sacral architecture through an interdisciplinary approach combining structural, social, and technological analyses. Four groups of research are addressing seismic resilience, vulnerability assessment, socio-historical context, and digital representation. Data from renovation projects and databases are acting as a support for the evaluation of unreinforced masonry, with classifications based on existing results and flat-jack testing. The MQI method will be applied in the research and adapted to Croatian typology. A rapid vulnerability assessment method will be developed through macroseismic principles and statistical analyses. Fieldwork and interviews will examine social, historical, and ethnographic significance. Digitalization enables visualization, while 3D-printed models illustrate structural behavior, damage, and retrofitting strategies. The first and introductory research works on the subject are shown.

Favorites:

Favorite paper:

Damage classification of residential buildings in historical downtown after the ML5.5 earthquake in Zagreb, Croatia in 2020

https://doi.org/10.1016/j.ijdrr.2021.102140

Conceptual design strategies for graded seismic strengthening of buildings

Personal motto
Never give up, unless you have to.
Grunf

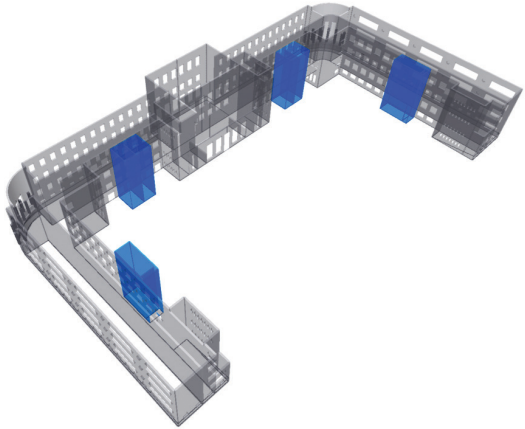
Name and Surname:
Juraj Pojatina

Affiliation:
Studio Arhing d.o.o., Croatia

Email:
juraj@studio-arhing.com

Biography:
Structural Engineer based in Zagreb, Croatia, with over 20 years of experience in steel, concrete, timber, and masonry structures. Special consultant for historic structures to the Croatian Ministry of Culture, structural engineering expert with the Croatian Centre for Earthquake Engineering (CCEE), seismic assessment expert for the U.S. Department of State in Southeastern Europe, and member of ICOMOS. Following the 2020 Zagreb and Petrinja earthquakes, actively involved in the assessment of public buildings and serving as a seismic expert on several committees of the Ministry of Construction, the Ministry of Culture, and the Faculty of Civil Engineering. Regularly participates and presents at international conferences on heritage buildings.

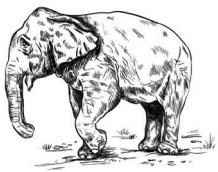
> I prefer honest arrogance to hypocritical modesty.
> Frank Lloyd Wright



Abstract:

This presentation proposes variant solutions for seismic strengthening of buildings, exploring different levels of invasiveness and their respective contributions to overall structural performance. The study aims to analyze the effectiveness of individual structural systems, strengthening techniques, and materials in enhancing the seismic resistance of specific elements, assemblies, or entire buildings. The case study focuses on three residential buildings of varying heights and floor plans. Different strengthening strategies are applied, including local reinforcement of existing elements, addition of new walls or tie systems, construction of seismically resistant stair cores or perimeter walls, and vertical prestressing of existing walls. Each intervention is conceptualized with an assessment of its impact on the existing structure, estimated cost, and duration. The purpose of this work is to establish a practical database of technical solutions categorized by type, providing a foundation for the development of effective strategies for the seismic upgrading of the existing building stock.

Favorites:



2

Seismic behaviour of existing precast reinforced concrete large panel buildings

Personal motto
Be positive.

Ko zna zašto
je to dobro…
(Who knows why
this is good…)

Name and Surname:
Svetlana Brzev

Affiliation:
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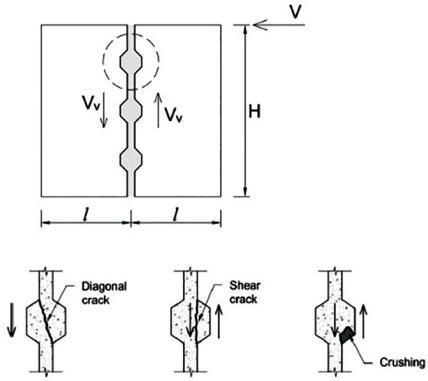
University of British Columbia, Canada

Email:
sbrzev@mail.ubc.ca

Biography:
Dr. Svetlana Brzev has 40 years of international academic and consulting experience related to seismic analysis, design, and retrofitting of reinforced concrete and masonry buildings. Dr. Brzev holds Bachelor's and Master's degrees in Civil Engineering from the University of Belgrade and a Ph.D. degree in Earthquake Engineering from the University of Roorkee, India. Prior to her academic career in Canada, at the British Columbia Institute of Technology and UBC (2000-present), she was working as a senior engineer at Sandwell Engineering in Vancouver on projects involving seismic assessment and retrofitting of buildings and other structures (1995-1999). She was a part of the research team which developed the Global Earthquake Model (GEM) from 2010-2013, and received the award for her contributions in 2016. Dr. Brzev served as Vice-President of the EERI, as a Director of the IAEE, and the founding President of SUZI-SAEE. Prof. Brzev has authored more than 200 papers and other publications, and 3 textbooks related to structural and seismic design of masonry and reinforced concrete structures. In 2015, she was named a Fellow of the Engineers Canada for her contribution to the engineering profession in Canada.



Abstract:

A need for rapid and affordable housing after the WWII prompted the development of precast reinforced concrete (RC) technologies. Large panel systems, composed of horizontal and vertical RC panels connected along the joints to form a box-like structure, were the most widely used precast RC systems for residential construction in Eastern European and Central Asian countries. A significant building stock of precast RC buildings exists in Croatia and the neighbouring countries, and were designed without considering ductile seismic behaviour of these structures. The presentation will discuss the key structural features influencing seismic response of precast RC large panel buildings, as well as the expected failure mechanisms of these structures under seismic loading. A methodology for estimating the seismic capacity of wall assemblies with horizontal and vertical joints will be presented and illustrated on the example of Jugomont system.

Favorites:

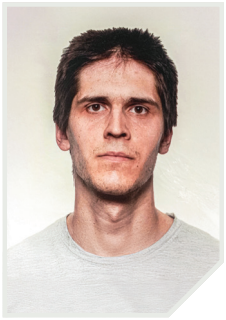
5

Favorite paper:

Residential building stock in Serbia: classification and vulnerability for seismic risk studies

https://doi.org/10.1007/s10518-023-01676-0

The case study of JU-61z, a precast RC large panel building



Name and Surname:
Romano Jevtić Rundek

Affiliation:
University of Zagreb Faculty of Civil Engineering, Department of Engineering Mechanics, Croatia

Email:

Biography:
Romano Jevtić was born in Croatia in 1997. He has gone through life always curious to understand how things work. This and some math and physics skills landed him in the faculty of civil engineering where skills otherwise scattered between hobbies could be focused on practical problems. Upon graduation he was employed as a PhD student specialising in seismic engineering, with a focus on standardised large panel buildings of 1950-60s. The main focus of his professional development is in numerical modelling of nonlinear behaviour in structures with complex failure mechanisms and teaching undergraduate students basics of rigid body statics and dynamics.

Personal motto
Try again.

Curiosity didn't kill the cat!

Abstract:
There is a significant number of buildings, made before adequate understanding of seismic loading, made using so called large panel structural systems. These buildings often exhibit unusual and complex failure modes making their seismic resistance difficult to quantify. In this paper a case study is presented, with an overview of the entire seismic analysis, utilising the multiple stripes method and time history analysis with direct integration, with the final result being new and relatively precise vulnerability curves. The focus of the paper is modelling of the case study building, with the aim to replicate relevant failure mechanisms well enough at the level of individual precast elements.

Favorites:

9

Favorite paper:

Analysis of a typical 1960s Large panel building seismic resistance
https://doi.org/10.32762/zt.2025.16

Seismic assessment of a high-rise residential building from the 60s

Personal motto
After all, tomorrow is another day.

Name and Surname:
Senad Medić

Affiliation:
University of Sarajevo Faculty of Civil Engineering, Bosnia and Herzegovina

Email:
senad.medic@gf.unsa.ba

Biography:
Senad Medić (born 1980, Banja Luka) earned his PhD from the University of Sarajevo in 2018 with a dissertation on the experimental and numerical analysis of solid brick masonry walls under seismic loading. He is an Associate Professor of Concrete Structures at the Faculty of Civil Engineering in Sarajevo. His research focuses on numerical and experimental modelling of structures, and he is actively engaged in professional practice through the Institute for Materials and Structures. He is married and the father of two children.

> Far better an approximate answer to the right question than an exact answer to the wrong question.

Abstract:
Older high-rise buildings with reinforced concrete wall–slab systems, commonly built in Europe during the post-war period, often lack adequate seismic detailing and fall within EMS vulnerability classes C and D. This study investigates a 20-storey residential building from the late 1960s in Sarajevo, constructed with minimally reinforced walls and limited seismic design guidance. Material properties were determined from extracted specimens, and seismic performance was evaluated through nonlinear dynamic analyses using recorded accelerograms. Despite several deficiencies with respect to contemporary seismic code requirements, the building exhibited generally satisfactory global behaviour, particularly in terms of displacement and interstorey drift demands.

Favorites:

e

Favorite paper:

Beam model refinement and reduction
https://doi.org/10.1016/j.engstruct.2012.10.004

Seismic performance assessment of RC high-rise buildings in the southern Euro-Mediterranean region

Name and Surname:
Jelena Pejović

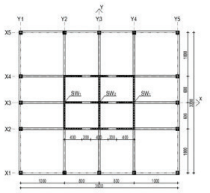
Affiliation:
University of Montenegro, Faculty of Civil Engineering, Montenegro

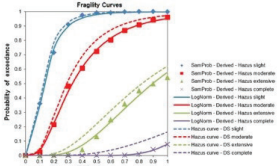
Email:
jelenapej@ucg.ac.me

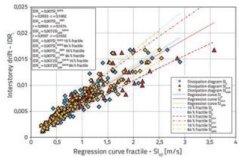
Personal motto
1+1=1

Biography:
Jelena Pejović is an Associate Professor at the University of Montenegro Faculty of Civil Engineering. She has extensive teaching, scientific-research, and professional experience in structural and earthquake engineering. She is the author of more than 70 scientific papers, including 19 published in international journals. She serves as Secretary of the Montenegrin Association for Earthquake Engineering (MAEE-CAZI) and is the National Delegate to the International Association for Earthquake Engineering (IAEE). Her research interests include seismic analysis and design of structures, seismic risk and vulnerability assessment in urban and rural environments, probabilistic performance-based methods, and the reconstruction and strengthening of existing buildings. She has coordinated several international research projects and projects funded by the European Commission.

> We live in the best of all worlds that are logically possible.
>
> Leibniz







Abstract:

This invited lecture provides an overview of research on the seismic behaviour of reinforced concrete high-rise buildings characteristic of the Southern Euro-Mediterranean region. The lecture addresses key aspects of seismic demand prediction, fragility assessment, and limitations of current code provisions for wall-dominated tall systems. Contributions include optimal intensity measures for probabilistic seismic demand models, improved estimation of inter-storey drift limits at the onset of damage, refined Eurocode 8 design envelopes for RC walls, and a comprehensive seismic fragility assessment for regional high-rise typologies. The lecture also presents an example of seismic structural health monitoring of a high-rise building in Montenegro equipped with sensors, illustrating the value of real-time data for validating analytical models and supporting performance-based design.

Favorites:

9

Favorite paper:

Seismic fragility assessment for reinforced concrete high-rise buildings in Southern Euro-Mediterranean zone

https://doi.org/10.1007/s10518-015-9812-4

Built, broken, better: seismic vulnerability modelling across a building's life

Personal motto
The devil is in the details.

Name and Surname:
Vitor Silva

Affiliation:
University of Aveiro/Global Earthquake Model, Portugal

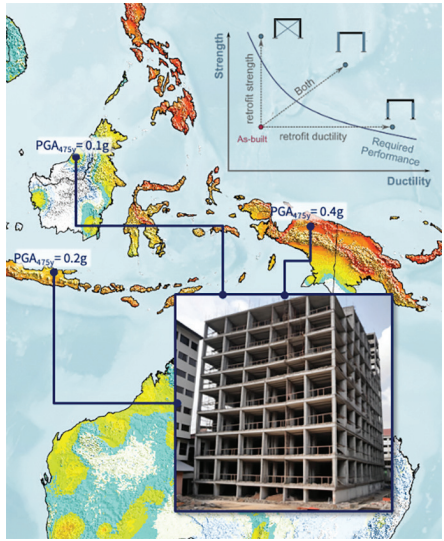
Email:
vitor.s@ua.pt

Biography:
Vitor is the Head of Risk Engineering Risk at the Global Earthquake Model (GEM). He leads studies in structural vulnerability, exposure modelling and probabilistic seismic risk assessment in dozens of countries. His research covers the assessment of earthquake impact at the global scale, incorporation of the temporal component in earthquake risk, and exploration of machine learning technology in the assessment of earthquake hazard, vulnerability, and exposure. He leads the development of GEMs Global Seismic Risk Model. He has authored more than 100 publications in peer-reviewed journals and earned several awards in the earthquake engineering field, including the EERI Shah Family Innovation Award, and the EGU Natural Hazards Division Outstanding Early Career Scientist Award and the ASCE Walter Huber award.

"Work hard, play hard!

Abstract:

Assessing the impacts of earthquakes depends on reliable seismic vulnerability models, which quantify the probability of damage or loss conditional on a given intensity measure level. Over a building's lifetime, vulnerability is not static: ageing, inadequate maintenance, and the accumulation of damage, whether from repeated ground shaking or other natural hazards, can progressively increase risk. Conversely, structural upgrades and retrofitting interventions can significantly reduce expected damage and losses. This lecture presents the Global Earthquake Model (GEM) vulnerability modelling framework developed to derive vulnerability functions for more than 1,400 building classes across three configurations: as-is, damaged, and retrofitted. The framework combines multi-degree-of-freedom (MDOF) systems with nonlinear time-history analyses to produce models that support the estimation of losses, damage, casualties, and even embodied carbon, metrics that are increasingly important for understanding the broader societal and environmental consequences of earthquakes. From built, to broken, to better, this lecture demonstrates that in seismic vulnerability modelling, the devil is in the details.



Favorites:

2

Favorite paper:

Seismic Risk Assessment for mainland Portugal
https://doi.org/10.1007/s10518-014-9630-0

From global to local: how collaboration with GEM will support seismic risk modelling in Croatia

Personal motto
Work hard, if you want something done, ask a busy person (side note - that usually means Vitor!).

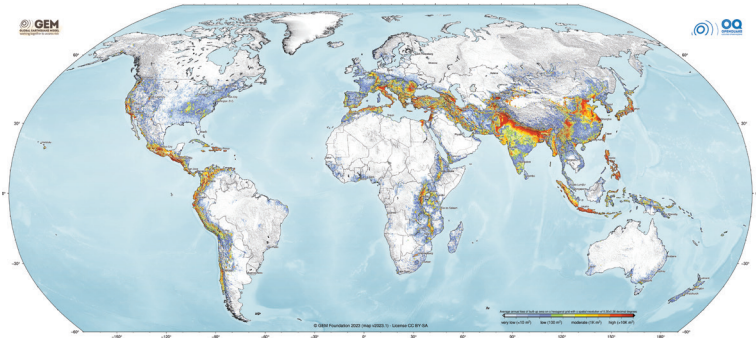
> Whether you believe you can or believe you can't, you're right!

Name and Surname:
Helen Crowley

Affiliation:
Global Earthquake Model (GEM) Foundation, Italy

Email:
helen.crowley@globalquakemodel.org

Biography:
Helen Crowley is Secretary General of the Global Earthquake Model (GEM) Foundation, a nonprofit, non-governmental organization that drives a global collaborative effort to develop open data, tools and software for state-of-the-art seismic hazard and risk assessment. She has an MEng in Civil Engineering, and both an MSc and PhD in Earthquake Engineering, and over 20 years of experience in seismic risk and earthquake loss modelling. She is the author/co-author of over 200 publications, peer reviewer for over 20 international scientific journals and has been Editor of Earthquake Spectra. Her awards include the 2009 European Geosciences Union Plinius Medal, the EERI's 2012 Shah Family Innovation Prize and the 2024 SSA/EERI Joyner Memorial Lecture.



Abstract:

The Global Earthquake Model (GEM) Foundation is a nonprofit, non-governmental organization that drives a global collaborative effort to develop open data, tools and software for state-of-the-art seismic hazard and risk assessment. Through partnerships in both the public and private sectors, GEM advances the global understanding of seismic hazard and risk. Croatia, though the Croatian Centre for Earthquake Engineering University of Zagreb Faculty of Engineering and the Intervention Service, has recently become a Public Governor of the GEM Foundation, with a seat on its Governing Board. Through this collaboration we plan to advance the development of a national seismic risk model for Croatia, as will be outlined in this talk.

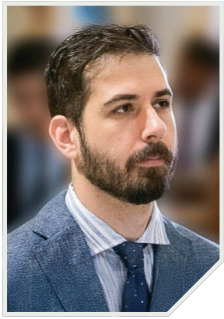
Favorites:

27

Favorite paper:

Can earthquake loss models be validated using field observations?
https://doi.org/10.1080/13632460802212923

Effects of seismic sequences and damage accumulation on risk analysis



Personal motto
It is what it is.

Engineering is the art of modelling materials we do not wholly understand, into shapes we cannot precisely analyze, so as to withstand forces we cannot properly assess, in such a way that the public has no reason to suspect the extent of our ignorance.

Dr A. R. Dykes

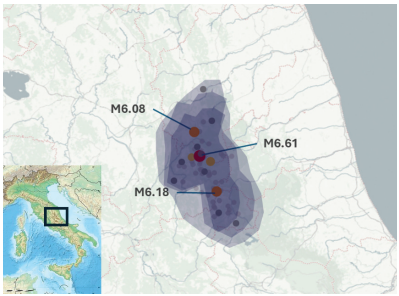
Name and Surname:
Pablo Alfonso García de Quevedo Iñarritu

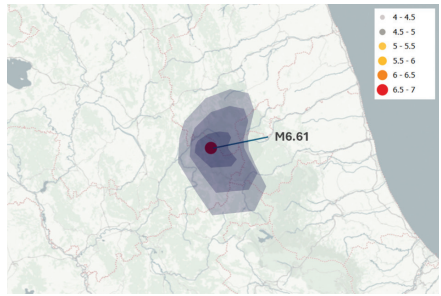
Affiliation:
University School for Advanced Studies IUSS Pavia, Italy

Email:
pablo.garcia@iusspavia.it

Biography:
Pablo Alfonso García de Quevedo Iñarritu is a civil engineer with experience in structural design, seismic risk assessment, and research. He holds a bachelor's degree in Civil Engineering from Universidad Iberoamericana in Mexico City, and a master's and PhD in Earthquake Engineering from IUSS Pavia in Italy. His research focuses on cumulative damage and seismic sequences in masonry buildings and their impact on seismic risk.

He began his career in Mexico (Alonso y Asociados), working on analysis and design of steel and RC structures. He later worked at ERN (Evaluación de Riesgos Naturales), integrating seismic risk models for the OASIS platform. He also conducted research at the University of Porto, developing seismic fragility and vulnerability models. He currently works at RED (Risk Engineering and Development), developing tools and models for seismic and natural hazard risks.





Abstract:

This presentation explores the impact of seismic sequences and cumulative damage on risk analysis for buildings. It highlights how conventional risk models underestimate their effects by ignoring the impacts of multiple earthquakes and damage accumulation. Improved assessment methods and models are discussed, emphasizing the need to account for repeated shocks, structural capacity loss, and updating fragility models. Case studies and simulations show that including sequences and cumulative damage can significantly increase risk estimates, especially for brittle structures. The findings underscore the importance of updating risk assessment practices to better reflect the seismic hazard and structural responses.

Favorites:

17

Favorite paper:

Optimized derivation of hazard-consistent seismic fragility curves using Bayesian approach and multiple stripe analysis

doi:10.1177/87552930251378780

Preparations for the new seismic hazard maps for Croatia

Personal motto?
Do it right!

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Biography:
Iva Dasović is an assistant professor at the Andrija Mohorovičić Geophysical Institute at the Department of Geophysics, Faculty of Science, University of Zagreb (FS-UniZg) since 2019. She teaches several mandatory courses in undergraduate and graduate study programmes at FS-UniZg on general and engineering seismology and science communication. She served as an associate editor for the Geofizika journal, and currently is an Editorial board member and its secretary. She is active in public outreach and science popularisation/communication.
Her main research interest is observational seismology, with a focus on (historical) seismicity analysis, seismic attenuation and engineering seismology. Currently, she is a Croatian PI on the trilateral project MAPS Seconds Matter: Cutting-edge Earthquake Early Warning Systems with ETHZ-SED (PI John Clinton, CH) and NIEP (Elena Manea, RO) financed by SNSF, HRZZ and UEFISCDI.

Abstract:

The current Croatian seismic hazard maps, published in 2011 as a national annex to the Eurocode 8 norm, display peak ground acceleration (PGA) for two return periods – 95 and 475 years – for soil type A (bedrock). In 15 years, many earthquakes have occurred, extensive research has been conducted in Croatia and neighbouring countries, numerous papers have been published and new seismic hazard maps are long overdue. Besides, the second generation of Eurocode 8 has introduced changes and PGA is no longer the required parameter, spectral acceleration is now needed. Let us examine some of the challenges and plans for the new Croatian seismic hazard maps!

Favorites:

7

Favorite paper:

Attenuation of high-frequency body waves in the crust of the Central External Dinarides

https://doi.org/10.1007/s10950-015-9498-8

Montenegrin earthquake from 1979 - lessons and experiences

Personal motto
If you can dream it - you can do it. Be who you want to be, not what others want to see.

Name and Surname:
Marina Rakočević

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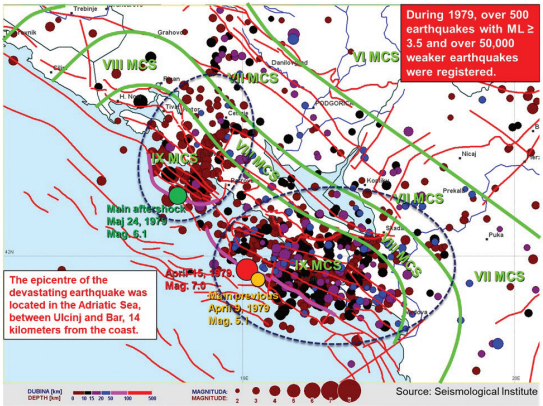
Biography:
Marina Rakočević is a full professor of Theory of Structures at the Faculty of Civil Engineering, University of Montenegro. Her research focuses on structural theory, numerical analysis, and the application of the Finite Element Method, with particular emphasis on layered and laminated structures, including delamination modelling using Layerwise and Zig-Zag theories. She has published extensively in international journals, monographs, and conference proceedings, with over 200 citations, and has participated in numerous national and international research projects. She has significant experience in leading research teams, supervising PhD students, and mentoring young researchers. Prof. Rakočević has held several academic leadership roles, including Vice Dean and Dean of the Faculty of Civil Engineering (2019–2025), and has been actively involved in editorial, review, and ethical committees at the university and international levels.

“Don’t judge a book by its cover.



Favorites:

8

Abstract:

The territory of Montenegro is characterised by very high seismicity. The devastating earthquake occurred in April 1979, destroying many modern facilities, as well as cultural and historical monuments, roads, and railways. This catastrophic earthquake caused enormous destruction and showed all the deficiencies of the previous way of building construction. The damage amounted to more than 15 billion US dollars in today's value. At that moment, Montenegro was not prepared or organized to act immediately after a disaster. With the help of the international community and organisations, local YU experts achieved excellent results in the years following the event.

The recovery period lasted almost a decade, and there are still damaged buildings that have not been completely reconstructed. Drawing on this experience, comprehensive knowledge regarding seismic risk has been incorporated into Montenegrin legislation concerning planning, design, construction, and supervision of buildings, especially within the national annexes of EUROCODE 8. In addition, Montenegrin society is facing new challenges in the field of earthquake engineering, both from a professional and scientific perspective.

Favorite paper:

A computational method for laminated composite plates based on layerwise theory
https://doi.org/10.1016/j.compositesb.2017.03.044

Dubrovnik - restoring a living city

Personal motto
Embrace the life without having a motto.

Name and Surname:
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Biography:
Mihaela Skurić is a civil engineer with 22 years of experience in heritage building restoration. She holds a specialist university degree in strategic planning and sustainable development. Since 2018, she is the director of the Institute for the Restoration of Dubrovnik, where she manages cultural heritage reconstruction projects funded by local, governmental, and EU authorities. Under her leadership, the Institute successfully developed the Management Plan for the UNESCO World Heritage Site of the Old City of Dubrovnik, the first one of a kind in Croatia. As Chair of the executive management board for the World Heritage Site, Mihaela oversees the implementation of the plan. She has delivered lectures at various international conferences, including those among UNESCO World Heritage Cities. Her contributions have established the Institute as a recognized partner in both national and international projects related to cultural heritage, as well as disaster and climate change risks.

“He who sleeps is not awake.

Abstract:

The 1979 earthquake severely affected Dubrovnik, damaging more than a thousand buildings. To coordinate systematic reconstruction, the Institute for the Restoration of Dubrovnik was established. Under its leadership, long-term restoration began providing revitalisation of the historic centre. After the siege and bombardment of Dubrovnik in the 1990s, the Institute again led the post-war reconstruction. Since 2000, a key ongoing focus has been seismic strengthening—injecting stone walls, installing steel ties and reinforcing building blocks to increase earthquake resistance. Carrying out such work in the historic core of a fully crowded medieval town is uniquely challenging. The construction site is simultaneously home to a few elderly residents, a rental space for dozens of tourists and a business environment for numerous restaurants, cafés and shops. The scaffolding blocks the views, the noise disrupts honeymoons and the reviews suffer. So why—and how—does the Institute persist?

Favorites:

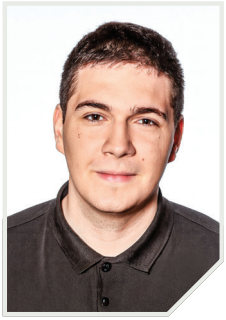
37

Favorite paper:

Management Plan for the UNESCO WHS Old City of Dubrovnik

https://www.ovpm.org/2021/04/14/management-plan-for-unesco-world-heritage-site-the-old-city-of-dubrovnik/

Seismic isolation of an existing reinforced concrete frame building in Croatia: post-earthquake rehabilitation feasibility, cost evaluation, and comparison with conventional retrofit



Personal motto
Do it right, or don't do it at all.

Name and Surname:
Krešimir Todorić

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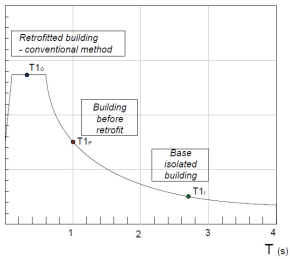
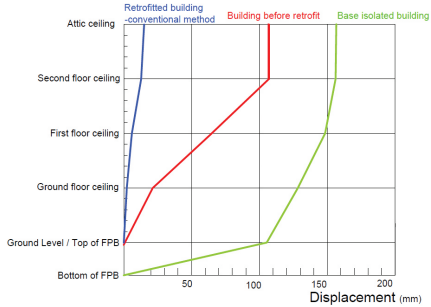
Biography:
Born in Zagreb, Krešimir is a young structural engineer trying to get a hold of all the deadlines and projects. When he started studying at the Faculty of Civil Engineering in Zagreb, he became fascinated by base isolation and other seismic devices. Now he is working in a civil engineering office, Toding, where he is truly grateful for the opportunity to do what he loves, to engage with projects of all kinds, and to apply modern technologies such as base isolation. In his free time, he tries to read as much as possible, spend time with friends, and travel the world.

> Theory without practice is pointless; practice without theory is dangerous.





Abstract:

Croatia is located in a seismically active area where moderate to strong earthquakes occur regularly. The building stock is relatively old and poorly maintained, resulting in high seismic risk, as shown by the damage from the 2020 Zagreb and Petrinja earthquakes. Reconstruction is currently carried out using standard strengthening methods, but base isolation has significant potential and could be an effective solution for certain building types.

This paper investigates the possibility of applying a base isolation system to an existing reinforced concrete frame building from the 1930s. A retrofitting solution with base isolation is compared with the conventional strengthening solution already implemented. Nonlinear analyses were carried out, and the seismic performance and construction costs of both approaches were compared. The results show the potential of base isolation as an effective solution for the reconstruction of existing critical infrastructure buildings.

Favorites:

9

Favorite paper:

Seismic isolation of the existing reinforced concrete building
https://doi.org/10.5592/CO/3CroCEE.2025.151

Experimental-based calibration of nonlinear models for reinforced concrete shear walls with different failure mechanisms

Personal motto
Everything can be done, but it doesn't have to be.

Name and Surname:
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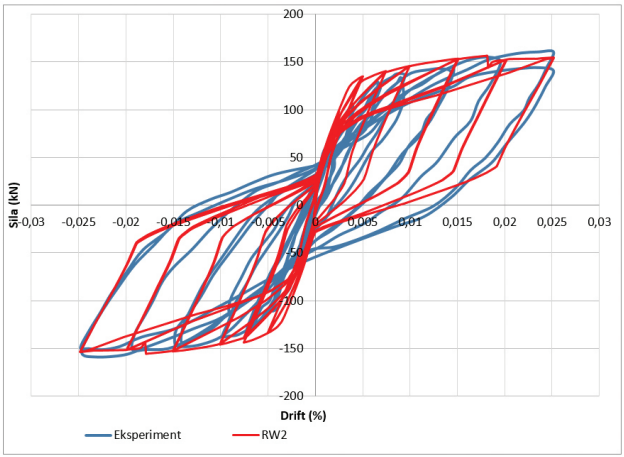
Biography:
Hrvoje was born in Dubrovnik on November 3, 1992. He enrolled at the Faculty of Civil Engineering at the University of Zagreb and graduated in February 2017 under the supervision of Assoc. Prof. Anđelko Vlašić, PhD.
He began his professional career in November 2016 as a junior structural design engineer, working on detailed and main structural projects. He is currently employed at Ekonerg d.o.o. as a structural design engineer.
As a member of the Croatian Chamber of Civil Engineers, he regularly participates in professional training through webinars and the Days of Certified Engineers. In January 2021, he volunteered as an engineer in the assessment of buildings damaged by the earthquake. In 2023, he started PhD studies under the supervision of Assoc. Prof. Mario Uroš, PhD.

> Everything can be done.



Abstract:

Shear walls are among the most effective structural systems for resisting horizontal actions and are widely used in buildings in the Republic of Croatia, particularly in older structures. Many of these buildings require seismic risk assessment and, in some cases, rehabilitation. Reliable modelling of nonlinear seismic response is essential and depends on the accurate representation of wall behaviour mechanisms. The behaviour of reinforced concrete walls is highly complex and influenced by numerous parameters, including concrete strength, reinforcement arrangement, confinement of boundary elements, and shear force level. Inadequate numerical models may lead to incorrect estimates of damage, strength, or ductility, resulting in improper engineering decisions. Therefore, calibration of numerical models using experimental data is necessary. This paper presents a methodology for calibrating nonlinear models based on three experimentally tested shear walls with different failure mechanisms.

Favorites:

8

What the ... is CCEE?

Personal motto
Everything
has its time.

Name and Surname:
Josip Atalić

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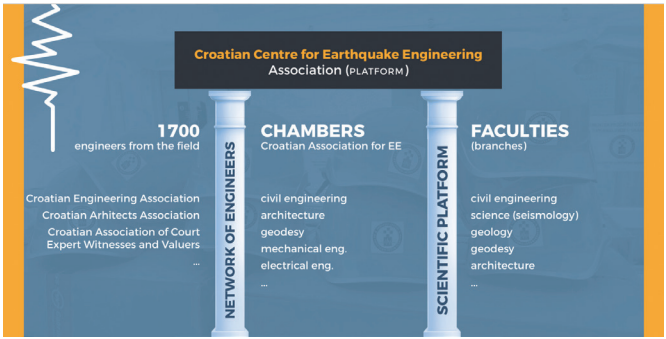
Biography:
Josip Atalić is a Professor at the Department of Engineering Mechanics, Faculty of Civil Engineering University of Zagreb and the head of the new branch office Croatian Centre for Earthquake Engineering. He is the leader of the expert team for National Risk Assessment in Republic of Croatia, member of several thematic Working Groups for National Development Strategy by 2030, a member of Croatian Civil Protection MUSAR team. After the earthquakes in Croatia in 2020, Josip led the organization of damage assessments and preliminary reconstruction cost assessment, made more than 100 lectures, organized 10 international seminars, he was Chairman of the Croatian Conference on Earthquake Engineering, and was one of the authors of two books/guidelines focused on the reconstruction process. He is the lead structural designer for the reconstruction of Zagreb Cathedral. He is also the head and one of the founders of civil association Croatian Centre for Earthquake Engineering – intervention service.

“Are You a Goodfool?
(this year).



Abstract:

After the 2020 earthquakes, in response to the numerous needs that arose during the recovery process, experts instinctively began to organize themselves with the aim of making knowledge and experience available, primarily to citizens in need, as well as municipal and state institutions and eventually to future generations.

Firstly, an online platform called www.hcpi.hr (the Croatian abbreviation for the Croatian Centre for Earthquake Engineering) was established, bringing together all available information relevant for the post-earthquake situation. The formalization of the platform started with the establishment of a branch at the Faculty of Civil Engineering Zagreb, the institution that played a major role in the organization of the system. Process was further accelerated after the strong earthquakes in central Croatia in December 2020 with the establishment of the Intervention Service at the national level. All parts of the platform contain CCEE abbreviation, which often causes confusion among stakeholder. In this contribution, we want to finally unravel this mystery.

Favorites:

3

Favorite paper:

Seismic risk for Croatia: overview of research activities and present assessments with guidelines for the future

https://doi.org/10.14256/JCE.2732.2019

Five years of seismic stress tests of the building stock in Slovenia

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Biography:
Matjaž Dolšek is a Professor at the Faculty of Civil and Geodetic Engineering, University of Ljubljana, where he also serves as Vice-Dean for Research and International Activities and leads the research program Earthquake Engineering. He teaches courses in earthquake engineering and structural dynamics. His bibliography includes more than 700 scientific and professional works. He has participated in numerous European, national, and industry-related projects, including projects related to nuclear and radiation safety in Slovenia. He is a member of the Slovenian Chamber of Engineers, the Slovenian and European Association for Earthquake Engineering, and the Earthquake Engineering Research Institute (USA). He was a member of CEN TC250/SC8 Project Team 1 responsible for drafting Eurocode 8. He is listed among the top 2% of scientists worldwide according to the Stanford University–Elsevier ranking.

Abstract:
The presentation will introduce three seismic stress tests carried out in Slovenia over the past five years. The first seismic stress test was in its final stage during the 2020 Zagreb earthquake. It covered the entire building stock of the Republic of Slovenia and was prepared for the former Ministry of the Environment and Spatial Planning as an expert basis for the Resolution on Strengthening Earthquake Safety in the Republic of Slovenia until 2025, adopted by the National Assembly in November 2023.
In 2024, a seismic stress test of the wider public-sector building stock was conducted for the Directorate for Energy. This year, a seismic stress test of the University of Ljubljana building stock was also completed. The presentation will highlight the key findings of these studies, illustrate different levels of seismic stress-test implementation, and present the concept of earthquake certificates used to communicate seismic risk.

Favorite paper:

I cannot select one. Perhaps the one that I had the most difficulty getting published.

Simulation of sustainable renovation of building stock in seismic areas

Personal motto
One thing at a time.

Life is not like a potica (a traditional Slovenian nut roll, usually sweet), it's like a watermelon—never sweet enough and always full of seeds.

Name and Surname:
Neja Fazarinc

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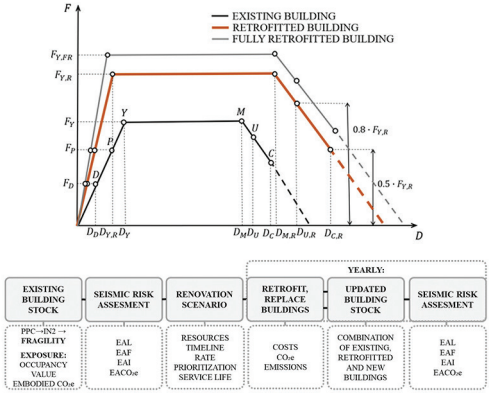
Biography:
Neja Fazarinc is a second-year PhD student at the University of Ljubljana, Faculty of Civil and Geodetic Engineering, where she also completed her bachelor's and master's studies. Her research focuses on the seismic resilience of building stock, particularly public buildings, including modeling of existing and retrofitted structures and long-term evaluation of the risk. She has contributed to the Probabilistic Seismic Hazard Analysis (PSHA) revision for a potential new nuclear power plant. Her master's thesis, awarded the Prešeren Award of the University of Ljubljana and the Dr. Darko Beg Award, addressed sustainable renovation of building stock in seismic areas with long-term assessment of economic, social, and environmental impacts. She enjoys teaching and mentoring students, programming in Python, and computational modeling.



Abstract:

A probabilistic framework for long-term renovation of building stock, addressing seismic risk, environmental impacts, and costs, is presented. It combines hazard analysis, fragility modeling, risk assessment, cost modeling, and life cycle analysis, applied to 6000 public buildings in Slovenia. Results show that scenario (1), which combines retrofitting and replacements, outperforms scenario (3) of replacement-only after 2029, reducing fatalities (EAF) to 23%, injuries (EAI) to 32%, and losses (EAL) to 52% of baseline by 2075. A full new stock achieves lowest risks (EAF 1%, EAI 3%, EAL 11%) but at prohibitive cost. In long-term, scenarios (1) and (3) converge at ~43% of full stock replacement costs. Environmental risk ($EACO_2e$) reveals that long-term earthquake damage emissions can exceed those from full replacement, stressing renovation urgency. Findings confirm that a balanced mix of retrofitting and replacement is the most sustainable, cost-effective strategy for risk mitigation.

Favorites:

7

Favorite paper:

Parametric pushover curve model for seismic performance assessment of building stock

https://doi.org/10.1007/s10518-023-01821-9

EPOS Croatia

Personal motto
Take it easy.

Name and Surname:
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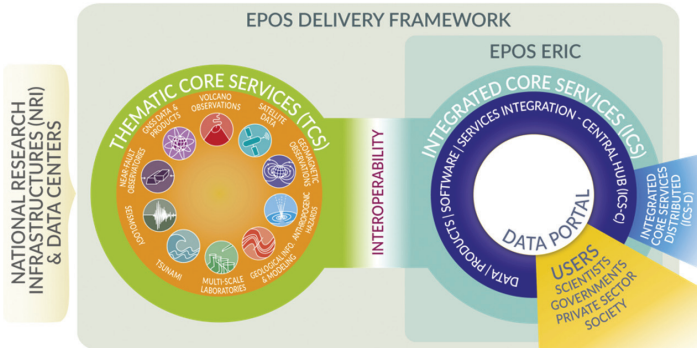
Biography:
Branko Kordić is a Research Associate at the Croatian Geological Survey (HGI-CGS) with a PhD from the University of Zagreb Faculty of Geodesy. His expertise includes satellite geodesy, remote sensing, photogrammetry, hydrography, cartography, geomatics, geodynamics, unmanned aerial systems, and GIS. Since 2020, he has led various projects in active tectonics, geodynamics, and engineering geodesy, applying modern techniques in interdisciplinary contexts. He has participated in numerous projects across academia, industry, and national institutes, focusing on advanced geodetic methods. After the 2020 earthquakes, he led interdisciplinary studies at the Croatian Geological Institute and collaborated with EU teams. Appointed in 2024 as the EPOS coordinator for Croatia, he works with industry on technology transfer. He holds certificates as an advanced user of GNSS, UAS, laser scanners, and multibeam echo sounders.

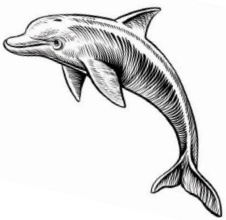
“Polite words
open iron gates.



Abstract:

By the end of 2023, Croatia joined EPOS, the European Plate Observing System, boosting its ability to monitor Earth's processes within the ERIC infrastructure. EPOS aims to unify national research systems into a digital platform for geoscientific data in seismology, geology, GNSS, and related fields. The Ministry of Science, Education and Youth (MZOM), with the Croatian Geological Institute (HGI) as the main coordinator, leads the Croatian EPOS-ERIC consortium along with seven other institutions. The project creates an interoperable digital environment consolidating various research infrastructures, providing valuable data and services. EPOS membership enhances Croatia's research, promotes international collaboration, and offers training for young scientists in digital tools and open science. With climate change and natural hazards, EPOS plays a key role in long-term monitoring, hazard assessment, and risk management, strengthening Croatia's position in European Earth sciences.

Favorites:



7

Favorite paper:

Rapid Remeasure of Dense Civilian Networks as a Game-Changer Tool for Surface Deformation Monitoring: The Case Study of the Mw 6.4 2020 Petrinja Earthquake, Croatia

Acknowledgements

The 2BeSafe team would like to express their sincere gratitude to all lecturers for their valuable contributions and presentations, which made this book possible. Special thanks to the members of the Organizing and Scientific Committees for their continuous support throughout the preparation of the conference and this book and thanks to all participants for honouring this event with their presence.

Let us conclude the book with some fun facts about favourite numbers and animals. The number 9 is the most popular, appearing five times as the chosen favourite number. We could therefore say that 9 is the number of the 2BeSafe conference. Interestingly, the number 9 behaves like a mathematical boomerang — no matter what you do with it, it always comes back to itself. Proof? Pick any number, multiply it by 9, add the digits of the result, if it is not 9 yet, add the digits again and finally you will always end up with 9, as if to say "You are now 9. You always were". Interesting, the famous phrase "the whole nine yards" has its origin probably from cement mixers, because older cement trucks, when full, carried nine cubic yards of concrete.

Moreover, the cat is the most popular favourite animal, appearing six times among the participants. In different cultures, cats are considered either good luck or bad luck. There is no middle and their reputation is very context dependent. Basically, humans have been both terrified of and obsessed with cats for thousands of years. A fun fact is that sailors noticed cats behaved strangely before storms, so cats were often brought aboard ships as "storm detectors". Anecdotal evidence from Japan suggests that cats were sometimes regarded as "early warning signs" of earthquakes. In Europe, cats were thought to be familiars of witches, guarding secret knowledge or magical powers.

Finally, how are cats connected with the number 9? A belief in many cultures is that cats have nine lives. The number 9 is considered magical, linking cats to superstition and mystery. In the same spirit, our 2BeSafe project will appropriately conclude under the sign of the cat and the number 9.

2BeSafe team

"Earthquakes: nature's reminder that your furniture needs seat belts too."

FINAL CONFERENCE OF THE

2BESAFE PROJECT

15–16 JANUARY 2026

FACULTY OF CIVIL ENGINEERING,
UNIVERSITY OF ZAGREB

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